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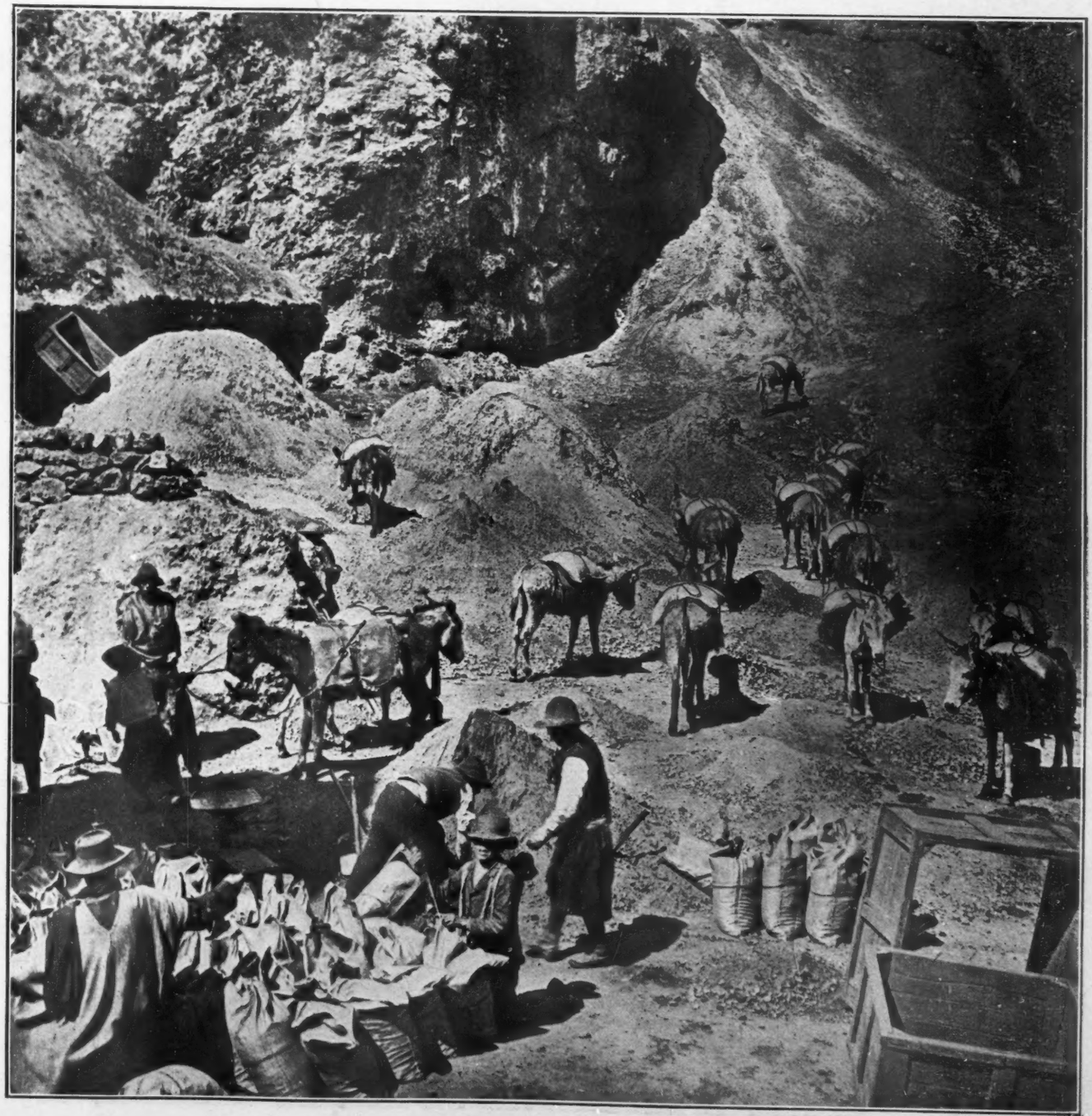

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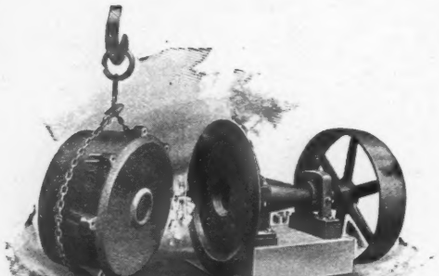

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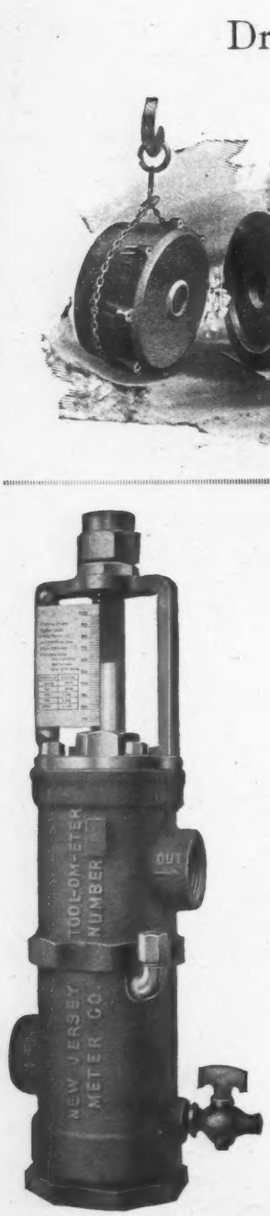

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VOL. XXV, NO. III *Contents Copyrighted* MARCH, 1920

The Air Lift—Principle and Practice

*By CHARLES J. DEEM**

WHEN AIR-LIFT pumping first entered the commercial field there were a great many conditions surrounding its operation that were unknown even to the manufacturers of the lifts. It has been charged by many, and more especially by engineers, that the manufacturers of air lift pumps wish to surround their products with mystery. I can truly say that this is not the case. The manufacturers of air lift pumps, like any other trades people, want to sell all of their products they can, and willingly give all the information regarding its operation that will make it more popular in the deep-well pumping field. However, they are limited in this service from the fact that no *master formula* has as yet been devised, whereby infallible rules may be laid down for the proper designing and installing of any and all installations, without any regard for the conditions that exist in the wells.

Some fifteen years of experience have taught me that in many, many instances, wells are just as individual in their actions as are persons. Therefore, a properly designed air lift installation, operating satisfactorily in one well, might give entirely different results when installed in another well which to an inexperienced operator might seem to be almost identical with the first.

While experience is not absolutely essential to the pumping of water from deep wells by the means of compressed air, yet, I know of no engineering field where experience counts for more or is more essential.

Some of our best engineers have branded air-lift pumping as a system sadly lacking in economy, but in such cases their judgment has been based upon results obtained from improper methods of piping in connection with inefficient air compressors.

How the Air Lift Operates

Contrary to a popular belief, the compressed air discharged through an air lift pump does not blow the column of water upward after the first discharge. When the static head is lifted from the working head of the well by the first inrush of air, the water is forced out of the pipe in a solid column. After that, the compressed air passing through the pump reduces the specific gravity of the water in the discharge line of the pump. This consequently moves upward by the expansion of the air bubbles, aided by the greater weight of the solid column of water surrounding the discharge line. In an economically designed air pump, it is imperative that the formation of large bubbles of air be avoided, for these have a tendency to rush upward without lifting the proper amount of water for the stored energy that they contain. Therefore, the pump should divide the air into small streams or jets, creating as many small bubbles as possible in order to give the best economy. The slip of these bubbles constitutes the chief loss in the energy of the air lift. It is figured that this varies as the square root of the volume of the bubbles. Therefore, the smaller the bubbles, the more efficient the air lift.

Pumping Costs and Repairs

Of course, one of the foremost things to be considered in the installing of a pumping plant, is its efficiency. I presume there is no one word in the English language that is used more in manufacturing and engineering circles than the word efficiency. It is a good strong word, but may be figured from so many different bases of calculation that all conditions in connection with the apparatus must be thoroughly understood before the percentage of efficiency that is claimed for it, can be valued. The only true way I know to figure the efficiency of a pumping plant is to add up at the end of the year the column in the ledger headed operating costs, and to calculate the results from its total. In this column it will also be found, if the items, such as repairs, break-downs, and their attendant losses are noted, and by reading between the lines, the worry that was caused thereby. Then it can be determined just how efficiently the system has operated.

In traveling over the country, I find that water works superintendents and manufacturers are more and more demanding workable commercial efficiency from their pumping machinery. They realize that by installing some closely adjusted high speed apparatus in their wells, they may be able, during its short life, to pump water cheaply per 1,000 gals. But in about nine cases out of every ten, such a pump is sure to cause trouble sooner or later, more often sooner. The small amount saved per 1,000 gals. pumped, during the course of the pump's successful operation, is far more than offset by repairs, shut downs and pulling of wells.

Underwriters' Recognize Reliability

To give you some idea of the faith that the underwriters of the country have in the reliability of the air-lift system, I will tell you Mr. Judd's experience with them in discarding deep well pumps and installing air lift systems in the city wells in Mason City, Ia. The Board of Underwriters in Chicago granted him 30 points on the key rate of insurance for the fire protection the increased yield of the well would afford the city, and they gave him 130 points because of the reliability of an air-lift pumping system. This is something that should be weighed carefully, for if there is any institution that figures from exact statistics, it is the underwriters. They don't guess, they know.

No one has yet been able to figure a master formula for the installation of the air lift. However, the manufacturers of air lift pumps have, at a great expense, gathered data from laboratory tests and field experience that enable them to construct formulas which cannot be universally applied to all conditions, yet they can define and introduce certain rules which enable them to calculate the requirements for an installation when the exact data are known.

When exact data are lacking, conditions are usually *assumed* and a lift installed. Then from results obtained, the engineer can, by basing his judgment on experience, proceed to pipe up the well so as to get economical results. To give an illustration of this, some years ago I installed an air lift in a flowing well on a ranch in southwest Texas. The well was eight inches in diameter, about 600 ft. deep and flowed about 20 gals. a minute. The owner of the ranch had only a small compressor, its maximum capacity being 30 cu. ft. of compressed air per minute. A 6-in. pump was installed, 200 ft. in the well, and this 30 ft. of air delivered to it. The head of the well dropped 20 ft. from the surface and the well yielded 530 gals. per minute, accurately measured over a knife-edged weir. Of course, this was phenomenal. Never before or since have I seen such a small volume of air deliver so much water from a deep well.

Recently at Fort Dodge, Ia., we installed a 6-in. pump in a flowing well, located in an is-

*From a paper before the Iowa Section of the American Waterworks Association.

land in the Des Moines river. The well was eight inches in diameter, 500 ft. deep and flowed 21 gals. per minute. The same size pump was located 200 ft. from the surface and we delivered to it 200 cu. ft. of air. The working head of the well dropped 150 ft. from the surface and yielded 80 gals. per minute. As one can readily see, this proved to be an uneconomical installation. Yet to all outward appearances, the conditions in the second well were the same as those in the first, and the results were not even comparable. It is in this second well that experience would have been necessary to have piped it up properly had the city decided to use it. However, they had plenty of other water available, so the well was abandoned. But an air lift could have been installed in it that figuring from the current input at the motor of the compressor to the water discharged in the reservoir, would have shown 30 per cent. efficiency. This could have been obtained by installing a 3-in. air lift and taking 50 per cent. submergence, or, in other words, by placing the lift as far below the working head of the well as we were going to lift the water. This would have yielded one gallon of water for 0.63 cu. ft. of air at 67 lbs. pressure. Of course, the starting pressure in this well would have been greater than that of the other wells of the system, yet this could have been offset by the use of an auxiliary air line to lift the head of the well.

Had the original installation in this well been let stand, any one wishing to speak disparagingly of air-lift pumping could have, in all honesty, cited it as an expensive mode of pumping water. On the other hand, some manufacturers, wishing to extol the virtues of their air pumps, might honestly print a glowing advertisement of the results obtained in the well first described. They would be equally misleading. The first is a result from what might be termed a freak well, while the installation of a 6-in. pump in the second well would be improper for the best results obtainable by the air-lift system. I only cite these two wells to illustrate my point that each well forms an individual problem, and that the same installation in all wells would fail to pump them properly.

Many wells pump a great deal of sand and as the air lift has no moving parts in the well, grit has no effect upon it. Any number of wells may be pumped from a central plant and there is no limit to the quantity of water that can be handled. With a properly designed system, the extra cost of pumping wells situated a mile from the power plant is not material.

It has been stated that an air-lift system requires little or no attention outside of keeping the compressor in proper running order. While this is practically true and cited as one of its advantages, yet sometimes it proves to be a disadvantage, because an installation will continue yielding water for years without giving any trouble. Yet there are times when the system becomes unbalanced, the working head of the wells recede, which changes the percentage of submergence, thereby reducing the yield of the well and increasing the amount of air required. So you can see that if the wells were checked up once or twice a year, and changes made to meet the new conditions, a great deal might be saved in operating cost.

Changing Conditions

Sometimes little things cause a great loss in economy. Not long ago I was called to a plant where a battery of five wells was being pumped from one compressor. The compressor at its maximum speed was barely large enough to pump the amount of water required. The operator told me that when the plant was first installed it gave excellent results, but there had been a decided falling off in the yield of the wells. The system was well designed and should have given good results. Upon investigation, I found that two of the wells were much weaker than the other three, and that they operated at about fifteen pounds less pressure than the other wells. When the engineer had balanced up the system, he had set the regulating valve at the well head of these two weaker wells so as to admit only enough air to pump the water that they would economically yield, and, of course, had left the valves wider open on the strong well. When starting the system pumping, the operator discovered that many times these two weak wells did not come in. Their static head being the same as the stronger wells, and being supplied with much less air they did not start so easily. In order to overcome this he had thoughtlessly taken a wrench and opened the valves of these two weaker wells. Of course, any force follows the line of least resistance, and the larger part of the volume of air, made by the compressor, rushed into the weaker wells from which it could not lift the same amount of water as it could have done from the stronger wells. Therefore, this system was out of balance and giving poor results, through no fault of the air-lift or the man who installed it. When air-lift systems are counted excessively costly to operate, I think it may safely be concluded that there is good cause for this, and that the chances are the troubles may be easily removed.

Determining Size of Pump

A great many mistakes are made when installing air lifts, especially by novices in the business, in choosing the size of the pump to be used to deliver economically a certain volume of water. In order to make that as plain as possible, I will give a concrete example.

If one wanted to lift 150 gallons per minute from a well with a working head 80 feet below the surface, the most economical pump to be installed would be a 3½ inch lift at 65 per cent. submergence. Under these conditions, this pump should yield one gallon of water for every 0.3 cubic feet of air at 67 pounds pressure. As one can easily figure, the pump would be situated 229 feet from the surface. Now suppose instead of being able to get 65 per cent. submergence, we can get only 40 per cent. sumbergence. In order to deliver 150 gallons per minute under these conditions, a 4½-inch pump should be used and one could expect one gallon of water for every 0.59 cubic feet of air at 25-pound pressure.

By a little figuring the engineer can ascertain that it required 1.1 more horse power to raise the water in the second instance than it did in the first. And I gave it, hoping to be able to show that even though conditions be vastly different in various wells, a properly designed air lift can be made to yield good results. But, of course, there are places and conditions under which some other type of pump should be used.

As can be noted from this example, as the submergence decreases, the size of the discharge line should increase. But this is only a general rule and the conditions in the well to be pumped wholly govern the change to be made.

Of late years some firms have been advocating a variable discharge line. I mean by that some firms wish to start with a smaller pipe and expand toward the point of discharge, the theory being that by allowing the compressed air more space in which to expand, it will lend more of its energy toward lifting water. On the other hand, some firms advocate turning this type of installation upside down, as it were. That is, they reduce the line toward the point of discharge, the theory being the same as the reason for choking the muzzle of a gun in order to keep all the gases behind the shot until it leaves the barrel. Of the two systems, so far as observation goes, the latter is to be preferred. I have seen it produce excellent results under some conditions. That is, it gets more water with greater economy than it would be possible to get from a uniform discharge line, made of standard pipe sizes.

I suspect the friends of the expanded discharge line system will challenge this statement and point to some installations they claim are a great success. I have seen one or two of these but they have invariably been installed in excellent wells that yielded large quantities of water very economically, not because of the system of expanding the discharge line, but in spite of it. However, improvements are being made in the system of piping and each year shows better practical results.

The Booster Pump

Another improvement in the air-lift system that I wish to mention briefly is known as the booster pump. This pump, or tank, is situated on the wall top and automatically separates the air and water as it is discharged from the well, on the well top and automatically separates the and retains just enough pressure from the separated air to force the water to the point of discharge. This is indeed a great improvement when the water must be transferred long horizontal distances toward the point of discharge. This point may be at the surface or an elevation. Hitherto, when horizontal distances had to be considered, unless the water was delivered to an elevated tank and allowed to flow by gravity, the air would get ahead of the water in the discharge line, thereby materially reducing the efficiency of the system. The booster, however, efficiently overcomes this condition.

I realize that I have given no tangible data on the air lift, but, as I have endeavored to

explain that, from the varying conditions that exist in all wells, any statements regarding the air lift system as a whole must be of a general nature. Some manufacturers have, at no little trouble and expense, conducted exhaustive, systematic tests in natural wells or in artificial wells constructed for the purpose of maintaining any desired submergence by feeding water into their tops. The data thus gained are authentic for the conditions under which they were gathered. However, in the field, nature does not make a habit of supplying her wells with water by pouring it in at the top. So you see we revert back to the same point from which we started. That is, each well presents a separate problem.

Another thing that has materially aided in the efficiency of the air-lift system is the perfecting of air compressors by the various manufacturers. The standard compressors now offered on the market in nearly every instance operate on from one-third to one-fourth the horse power that was required by the compressors built some ten or twelve years ago. Not only is the economy of these machines much greater but also the mechanical parts have been greatly simplified, thus making the air compressor one of the most economical machines now on the market.

AIR MACHINERY EXPORTS

The Bureau of Foreign and Domestic Commerce of the Department of Commerce, has provided for publication the following table of exports from the United States of air compressing machinery, by countries, in the last month for which records are available, November, 1919.

Countries	*Dollars*
Belgium	11,107
France	25,363
Italy	12,285
Norway	2,427
Portugal	72
Spain	3,469
England	58,163
Scotland	1,204
Canada	13,607
Honduras	163
Panama	203
Salvador	375
Mexico	2,425
Newfoundland and Labrador	42
Cuba	21,124
French West Indies	15
Argentina	2,936
Brazil	83
Chile	2,358
Ecuador	2,798
British Guiana	305
Venezuela	668
China	330
British India	6,767
Straits Settlements	833
Hongkong	1,900
Japan	9,300
Russia in Asia	384
New Zealand	424
Other British Oceania	732
French Oceania	8
Philippine Islands	7,036
British South Africa	652
French Africa	350
Total	$189,908

The Famous Highwall Corinth Canal of Greece

(C) Kadel & Herbert, New York City.

Here is depicted one of the celebrated rock-cutting jobs of the world, that required in the piercing through of the Corinth waterway to Athens, known for its exceptionally lofty walls and picturesque scenery. It is classed in this regard, and also as an engineering undertaking, second only to the Panama Canal. Rock drills, compressed air and dynamite made this water thoroughfare possible. Our photograph shows U. S. S. "Barney" making the passage.

In a lecture before the Manchester Association of Engineers on "Scientific Management," Mr. H. W. Allingham said it was too common for directors to engage a works manager and leave everything to him because he was supposed to know his job. The manager, in turn, hired a foreman, who also knew his job; and the foreman engaged workmen who knew their jobs. The result was that 90 per cent. of machine tools were probably producing only half of what they might.

The nitrate of lime factory at Rjukan, Norway, is claimed to be the largest water power station in the world, and to be able to produce 200,000 kilogrammes of nitrate per day. At present the output is 2,000 barrels per day, but a cooperage has been installed which can make 5,500 barrels a day.

The Morse Dry Dock & Repair Company of Brooklyn on Jan. 7, placed in dry dock the steamer *Minnesota*, one of the largest cargo ships afloat, in the record time of twenty-five minutes. This was the first time that all six sections of the dry dock have been used.

Thrilling Rescue Fourteen Days after Mine Cave-in

Fig. 1 shows part of the mine rescue crew. Fig. 2 shows the drilling equipment, the arrow indicating the pipe through which the soup was poured. Fig. 3 is a view of an underground kitchen where food was kept warm. Fig. 4 shows five more members of the rescue crew.

By WALTER E. CARR

THE FOLLOWING NARRATIVE of how two men, Peter Grant and Emil Sayko, were buried alive for two weeks in a cave-in in a mine in the Coeur de'Alene district of Idaho presents a striking and realistic picture of a heroic effort on the part of the mine crews to reach their imprisoned comrades by several attempts to drive a raise through from the lower levels. It also serves to show the successful application of modern mine rescue methods which must have had for their inspiration the old proverb, "While there's life, there's hope."

ON NOVEMBER 15, 1919, Peter Grant and Emil Sayko went to their work in the Gold Hunter Mine, situated in the suburbs of Mullan, Idaho. They were cleaning up in what is termed the Northwest stope, preparatory to taking a contract. The Northwest stope is an extension of the old Ryan workings, which had caved in, in 1913, and were filled with broken rock and timbers to the 33d floor. There was, however, a chamber between the top of the muck pile and the roof, there being about 60 feet of solid rock between the roof and the level above. The extension had not been worked for some time and these men were up on the top of this stope arranging to drive a raise 110 feet through hard rock to the level above.

The extension stope was timbered with square sets, one above the other, for 35 floors above the level. The timbers were carried close up to the back of the stope and the stope was filled with broken rock (excepting the space necessary for the rock chute, manway and timber chute) from the 3d to the 22d floor,

this being done as a safety precaution to hold the walls apart. From the 28th floor there was practically no stoping done, this part of the stope being more in the form of a raise. Running out from the 26th floor was a crosscut in solid rock 48 feet long, which had been run to prospect the ground.

The men had finished their temporary work and were descending when they heard a sharp crack and felt the timbers give. Sayko returned for his carbide, which he had left above a short distance and when he returned to where Grant was waiting the timbers again began to move and crack and both men made a rush for the solid rock crosscut, which ran out 48 feet from the 26th floor, where they felt reasonably sure they would be safe. They barely had time to reach the crosscut, when down came many tons of rock, crushing the timbers of the extension or Northwest stope and blocking every exit and the men realized they were absolutely locked in from the outer world.

Every means was exhausted by rescue crews to reach them through the old workings, and every effort was in vain, as all openings were blocked with great masses of loose rock and timbers. A raise was started from a point which seemed to be a safe place and was headed towards a narrow part of the extension stope, but was soon abandoned, owing to every movement being hampered by loose rock. Another raise was started in another section which was also loose muck, but proved to be very discouraging.

In the meantime a diamond drill had been rigged up and a contracting firm in Spokane furnished the crews, the men arriving in the shortest possible time. The diamond drill was started on November 21, directly above the old Ryan stope and a hole was put through the 60 feet of solid rock in fifteen hours.

The men were alive, as those listening and carrying on signals, could hear faint replies from time to time.

About this time, the Bureau of Mines, at Washington, was requested to furnish a new device for detecting sound underground, known as the geophone. The department immediately made reply and sent two men as well as the apparatus for the work and they arrived as quickly as steam could bring them. This was indeed encouraging to the management and the tireless crews of men struggling to reach the entombed miners through the raise in the muck. This raise was continued for six days, reaching about the 24th floor, when the whole muck pile moved, closing in two men, Jack Delmarh and James Collins, of the raise crew.

It was hardly reasonable to expect that these men would remain alive, in view of the fact that they were caught in such a great mass of material, but such was the case and they were rescued after about fifteen hours' imprisonment.

It was necessary, of course, to abandon this work, but in the meantime, the diamond drill had broken through into the old Ryan stope and communication had been established with the entombed men and water and hot soup had been given them. All this time, however, they were exposed to the dangers of caving ground in the old Ryan workings.

The entombed men afterward stated that they heard a dripping of the seepage from the drill hole, and hastened in the direction of the sound and caught the water in their lunch buckets—the first water they had tasted in four days.

When the hole was drilled, the drillers pushed a ½-inch galvanized pipe through the hole which struck Grant on the head. He immediately grabbed the pipe and gave it a hard shake, which conveyed to those on the surface the information that they had reached the entombed miners. To give an idea of the careful method of procedure, a whistle had been attached to the end of the pipe to signal the men, in the event they had not been attracted by the sound of breaking through the drill hole. This was removed and parties above and below soon were in communication.

The first request made was for a light and a wire was passed down on the outside of the pipe, with a two-candle power lamp attached, the lighting power being furnished by a storage battery. Hot water was poured through the pipe to warm it, and then soup, milk, and other supplies, were delivered to the hungry men. Many yards of a fine silk fabric was passed through the hole for the men to use in wrapping their bodies to keep them warm. Soon another hole was drilled and reamed out to two inches. Metal receptacles were made 1⅛-in. in diameter and 24 inches long, which were filled with chopped vegetables, meat and fruit. These receptacles were pointed on one end, with a screw eye soldered into the point, the other end having a loop of wire soldered on in the form of a bucket bail. Under this bail-like loop was the stopper, which sealed the hole through which the receptacle was filled. After being filled they were tied together by means of fine wire being run through the screw-eye of one and through the wire loop of another and fastened until a long chain of these receptacles was formed and then this chain was lowered through the hole.

The reason for pointing the tins was to avoid any wedging in the hole, which might occur, if the lower end had been left square. The square end would hang up much more readily, on rough points of rock in the drill hole, should there be any broken up ground encountered when drilling the hole. A large number of these receptacles and long, round loaves of bread, which had beeen wrapped in waxed paper, were lowered through the large hole. Fearing the caving condition of the ground, enough food and water were lowered through the holes to last the men two weeks and they were instructed to carry the food back into the rock crosscut on the 26th floor of the extension stope. With a sufficient quantity of provisions, candles, and other supplies, the men were made quite comfortable.

By this time, another raise was progressing rapidly through hard rock, the rescue crews using the most powerful and latest type of stoping drills and it was advisable for the entombed men to remain where there was little danger of the ground caving, owing to the frequent blasting in the rock raise.

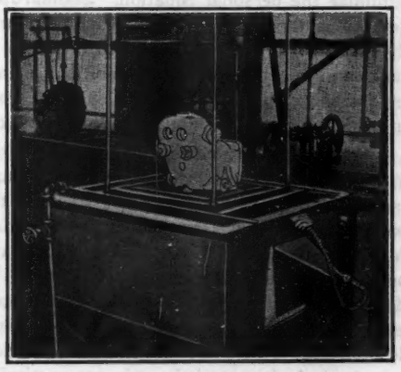
This work continued with the greatest efforts being made for speed, both day and night, by six-hour shifts, until on November 29, at three o'clock in the afternoon, the raise was finished, 90 feet having been driven through hard rock in seven days. The men were rescued, after being entombed for 14 days and four hours.

Before being taken above ground, their eyes were bandaged and then they were rushed to the hospital at Wallace, where were facilities to permit every attention being given to the two men. They were apparently feeling quite well, considering their experience. The wives of these men, it should be noted, deserve much credit for the encouragement they provided their husbands after communication had been established.

It is gratifying to note how the entire resources of the district were thrown open to assist in the rescue, and how the tireless crews were always ready to take their shift.

AIR-TESTING AUTOMOBILE ENGINE CYLINDERS

Mr. Fred H. Colvin in *American Machinist* describes with careful detail the various special equipment and the operations involved in the manufacture of automobile engine cylinders.



The testing tank

When the work upon a cylinder is approaching completion, the extraneous metal having been removed and the surfaces made ready for the finishing, it is necessary to make sure of the air-tightness of the casting as a whole by subjecting it to a sufficient internal pressure, and for this purpose special arrangements have been devised as here shown.

There is here seen a tank filled with water with a vertically movable horizontal rack upon which is placed the cylinder to be tested. The various openings of the cylinder are properly capped and an air hose is connected which applies the necessary pressure. The rack being counter-balanced to compensate for the weight of the cylinder it is easily lowered into the tank until the cylinder is entirely submerged when if there are any leaks they will be immediately revealed by the escape of bubbles of air up through the racks. At the side of the tank is a carefully hooded incandescent light which shines through a glass plate in the side of the tank so that the smallest bubbles are instantly revealed. It is not stated how many air leaks are thus discovered, but certainly enough to make the test indispensable.

Good Drill Steel Kept Always Sharp

By GEORGE H. GILMAN

The above title formulates the secret—although there is no secret about it—of success with pneumatic tools, and it is the keynote of the following which we reproduce, with some necessary condensation, from a recent issue of Granite, Marble and Bronze.

QUITE OFTEN one of the biggest leaks in the stone working plant is to be found in the point of the cutting tool. Whether it be the point chisel or the surfacing hammer in the stone shed, or the rock drill bit in the quarry, the point of the cutting tool is continuously the "business end" of the whole industry. In determining the successful employment of pneumatic tools we must start at this business end:

First—By selecting cutting steel of the required quality.

Second—By forging the cutting tool to the required shape.

Third—By subjecting it to proper heat treatment.

Fourth—By allowing no let-up in this system of maintenance.

We all know that this is a machinery age; that machinery will be made and used more and more as the years go on; but few of us stop to realize that the success of machinery is largely due to the fact that it serves merely to minimize the personal equation. Standardization of method is nothing more than a mechanical application of thought to the work in hand, and it behooves us to establish a standard method of procedure applicable to all work on which there is a duplication of operation.

As applied to the cutting tool, the material from which the granite point, chisel, set and drill is made, should be selected to meet the existing conditions, after which the selection should be rigidly adhered to and a standard method of procedure adopted for working it. Metallurgy has taken such strides in the past few years that it is now a comparatively simple matter to secure the chemical composition and physical characteristics of any particular grade of steel, which after being determined should be used as the basis of a standard set of specifications, for there is nothing more disconcerting to the blacksmith than to be forced to work steel of varying chemical composition which invariably is found in the smith's shop when material is purchased from several sources, with no more rigid specifications than the mere statement that granite point, surfacing chisel or drill steel is what is wanted.

After the material is standardized for the work, smiths should be taught to forge the tools at a safe working heat. All blacksmiths know that the hotter steel is heated preparatory to forging the easier will be the work of hammering it into shape, while but few tool sharpeners realize the disastrous effect of overheating, which is detected only when the finished tool is subjected to service, and then it is usually the steel that is condemned instead of the real cause of trouble being determined and checked.

The next important lesson that the blacksmith should be taught is the fact that, in the operation of tempering or heat treating, all straight carbon steel should be quenched when heated to the critical point regardless of the method employed for drawing the temper. It is called the critical point because it is the point in the temperature of the piece being heated, at which a change takes place in the structure of the steel, due to the carbon being dissolved. It is the point below which steel will not harden when quenched, and by coincidence it is the point at which the steel loses its magnetism. For the purpose of illustration, take a bar of rock drill or granite point steel about ten inches long, and nick it in six or eight places placed equidistant, to make it break easier. Put one end in the fire and heat it to a white heat, letting the heat gradually run out to a dull red at the opposite end of the test piece and then quench the entire bar in cold water. Now, break the piece at each nicked place and it will be found that the fracture that is closest and finest grained was nearest to or at the critical point. A skilled smith may thus determine the point by experiment and gauge the heat by taking note of the color, but this method is unreliable unless a check is provided, for oftentimes the eye gets off color, being influenced by the degree of surrounding light and the physical condition of the operator. In the absence of a pyrometer equipment the following may be adopted as a check.

A small pocket compass, preferably with a jeweled needle and stop which may be procured in almost any jewelry or hardware store at a nominal cost, and a pair of brass or other non-magnetic tongs are the only essentials. This compass should be set upon a wooden block in close proximity to the forge and in such a position that the natural swing of the test piece back and forth when being tested will be in a plane at right angles to the needle. In other words, the test piece being hardened should be swung east and west, using brass tongs. By passing the test piece forward and backward close to the compass, the magnetism of the metal will cause the needle to be deflected first one way, then the other and will continue to deflect the needle until the proper heat for quenching has been obtained. The right heat is reached when the material loses its magnetism. It does not follow, if the needle remains stationary the first time you test, that the heat is right, because after the material has reached a certain degree of heat the magnetism leaves the steel, so there is no influence on the needle and it may be too hot. Different grades of drill steel having different carbon content require different degrees of heat. The magnetism leaves the steel at that degree of heat corresponding to the carbon content in the steel and in every case this is the proper heat for quenching.

When high carbon steel is heated to the critical point and cooled rapidly by quenching in ice cold water, maximum hardness and density is obtained and it must be remembered that density of structure is equally as important a factor as hardness in rendering the tool both shock and wear resisting. The required degree of toughness is secured by varying the rate of cooling when the piece is quenched at the critical temperature and as applied to the cutting point of the tool, this must be varied to suit the requirements of the work.

For the shank or striking end of the tool, density and toughness are more to be desired than hardness, so for general work the desired result may be secured by heating to the critical temperature the entire shank end for a short distance below the collar or shoulder, dipping the tip end in cyanide of potassium and then quenching in oil, letting it remain in the oil until cool.

Let us for a moment consider the resultant effect of operating on a drill steel or chisel that has been injured in the smith shop. Regardless of whether it has been overheated preparatory to forging, overheated preparatory to quenching or quenched at too low a heat, the general result is the same. The cutting end of the tool is rapidly dulled in service due to the absence of wear-resisting qualities, and loses its ability to penetrate the rock when struck, so that the shock must of necessity be absorbed in the steel itself or transmitted back to the actuating engine. The effect of continued hammering with a dulled cutting tool upon the granite is exactly the same as that of operating against an impenetrable substance, such as a hardened anvil. Minute fatigue checks are established throughout the length of the drill or chisel. As the strength of a chain is determined by its weakest link, the ability of a piece of steel to withstand vibratory shock is determined by its weakest point.

It is at this point that one at least of the fatigue checks will have been established. Initially it may be so small as to be hardly detectable by the naked eye, but with continued operation it gradually grows larger by assuming a semi-circular or arc-shaped appearance, extending into the body of the material. As this check enlarges it is caused to open and shut as the vibratory stresses to which the cutting tool is subjected affect it. A breathing action is thus established which when the gap opens causes an inrush of the surrounding air carrying with it impurities, a part of which are retained when the mouth closes. It has been determined that it is these foreign particles sucked in with the air, which give to the surface of the check a discolored appearance and that the relatively smooth surfaces of the fracture are due to the hammering action to which they are subjected by the closing of the jaws for every cycle of vibration. Eventually

the steel or cutting tool is broken apart with the balance of the section disclosing a good, clear fracture of the metal in its original condition.

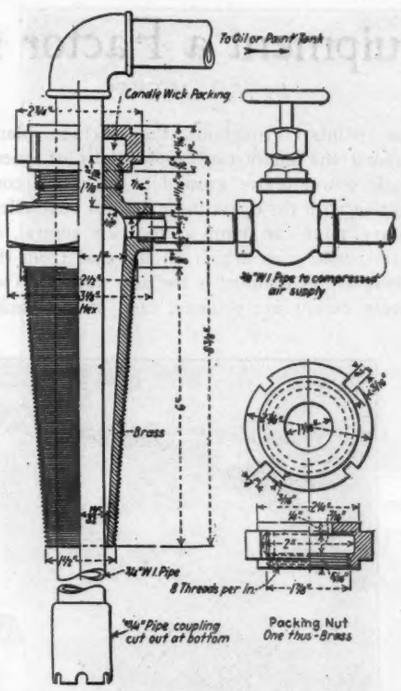
The effect of operating on a dull drill bit or chisel is not confined to the cutting tool, for it must be remembered that the cushioning effect due to penetration of the chisel in the material worked upon, alone makes possible the successful operation of every part comprised in the make-up of the pneumatic hammer or the rock drilling engine.

The natural question that arises in the mind of the progressive operator when impressed with the extent of an existing leak that is obviously caused by negligence or faulty workmanship is: "Can I adopt a practical mechanical method that will be an improvement?"

Perhaps no phase of granite production offers more opportunity for improvement at the present time than the forming and heat treating of the cutting tools that are used with pneumatic percussive machinery. This naturally suggests the installation of mechanical means, both for forming the tools and for giving them the required heat treatment. Fortunately in recent years great strides have been made on the part of the machinery manufacturer in making accessible to the granite and other industries machinery that will fit this requirement, for we now have available the pneumatic drill sharpener in a variety of sizes, and in addition we have the oil or gas forge with indicating signal pyrometer which enables the operator to maintain the required heat for either forging or heat treating, within very close limits. These two mechanical appliances, when used in combination, will enable the operator to produce cutting tools that are forged and heat treated under conditions that meet the requirements both of the work and of the material from which they are made. Neither the drill sharpener nor the forge are automatic in their operation, for which reason they bear only the same relation to the result that a good rock drill or a good cooking stove under the observation of a good operator, will bear to the result of their respective applications. They but make possible the results that are demanded, and with a minimum of effort on the part of the operator.

It used to be an accepted theory that the installation of a mechanical drill sharpener was unwarranted or unprofitable if one blacksmith or tool sharpener and his helper were capable of keeping the quarry or stone shed supplied with drills or tools that were sharpened by hand, but today, while this assumption may be used as a barometer for general guidance only, operators are now more inclined to use the words, "properly sharpened," prefixing the words "drills" or "tools."

The instructions for the care and use of pneumatic tools as furnished by their respective makers should be carefully followed, for only by so doing will the effectiveness of the tools be maintained. It is a wasteful leak to operate a machine that is lacking in effectiveness; not only does it waste air, but in addition the operator's time and fixed plant expenses are directly chargeable against it.



Air pressure device for oil transfer

AIR PRESSURE DEVICE FOR THE TRANSFER OF OIL

The illustration shows a handy means of removing oil or other liquids from barrels or other closed containers for transmission to permanent shop tanks or elsewhere. It is essentially a homemade device of the class so numerous in railroad shops where a supply of air at suitable pressure is always available, and the dimensioned drawing is reproduced from the *Railway Mechanical Engineer*.

It comprises a long, finely threaded taper plug, with diameters ranging from 1½ to 2½ in. which may be screwed into any ordinary bunghole, or, if more convenient, into a hole in the barrel head. The oil delivery pipe which is long enough to reach the bottom of the barrel slides in a stuffing box which makes a practically air tight joint.

When a barrel is to be emptied the plug is screwed into the bunghole, a small air hose is connected to the pipe at the side and connection is also made from the delivery pipe to the point where the oil or other liquid is to be deposited. A slight opening of the air valve admits pressure above the body of liquid and it is driven up the delivery pipe with any permissible rapidity.

For small pneumatic hammers such as carving tools, plug drills and surfacers, a practical way to determine the relative effectiveness of the different machines and the effect of wear upon the parts of a machine in service is to operate the tool equipped with a 60-degree conical or ball-pointed punch ground accurately to size, under a standard set of conditions that comprise air pressure, hose line and throttle opening, upon a finished plate of annealed low carbon machinery steel or other soft metal of a known chemical composition that has first been drilled with a series of 18-inch holes, spaced one inch apart, for the purpose of guiding the punch and maintaining it in proper vertical position. After the hammer has been caused to operate upon the plate for a time period of ten seconds the diameter of the depression caused by the punch is carefully measured under a magnifying glass and recorded for future reference by inscribing the date and the number of the tool adjacent to the depression. All small tools should be tested in this manner at least once a week and brought up to a recorded standard of operative effectiveness by proper repair, if found to be low in cutting capacity. When testing, the plate, which should be at least one-half inch thick, is clamped upon an anvil or other suitable support that will provide the required rigidity. It should not be forgotten that the success of the pneumatic machinery manufacturer lies in his ability to meet to the best advantage the requirements of the customer as they exist and in assisting customers to adapt the existing conditions to the machinery that has been developed for the work; hence the accepted fact that "field service" of the reputable manufacturer of such pneumatic machinery is, as applied to the user, of an equally great importance to his product.

A French mining company, it is stated in an exchange, will use aeroplanes to locate and open up mines in a concession of 400 miles in Africa. This is in accordance with the modern idea, and the progress of the undertaking will be watched with much interest. In the first place the company's engineers will endeavor to locate paying deposits, the aeroplane enabling them to keep in daily touch with central quarters, and as the mines are discovered the full aeroplane service will be used in the transport of miners and machinery to enable the quick development of the mines. Even though the mines are scattered over the whole area, the inspection will be comparatively easy with the aid of the aeroplane, and it will be possible for the directors and even shareholders to view the properties at frequent intervals. That the aeroplanes will prove a valuable adjunct to mining development is a foregone conclusion, and no doubt other companies will follow.

Cuba's present sugar crop is expected to yield about 4,300,000 tons, a record output. At prices which the planters are expecting this will mean $750,000,000 to $800,000,000, which would be around nine cents a pound. This is for one crop raised on an island of only 45,896 square miles and a population of 2,500,000.

In New York City daylight saving is to be resumed this spring, regardless of Federal law, according to an ordinance passed unanimously by the Board of Aldermen, and approved by the mayor last autumn. If this ordinance goes into effect the clocks will be set ahead on the last Sunday of this month, and restored on the last Sunday in October, as was done the present year in conformity to the Federal law.

Compressed Air Equipment a Factor in Mining Economy

*By H. L. HICKS**

SINCE the days of the waning use of compressed air-driven punching machines, and the conversion of the majority of mines to electric power and motor-driven coal-cutting machines, there has been a decided return swing of the pendulum. To-day, compressed air is again, it may be said, indispensable; if not for undercutting the coal seam, for other mining operations not a whit less important. Time and experience have made it clear that electric power and electrically driven equipment alone cannot perform all the varied tasks included in the general term, "coal mining."

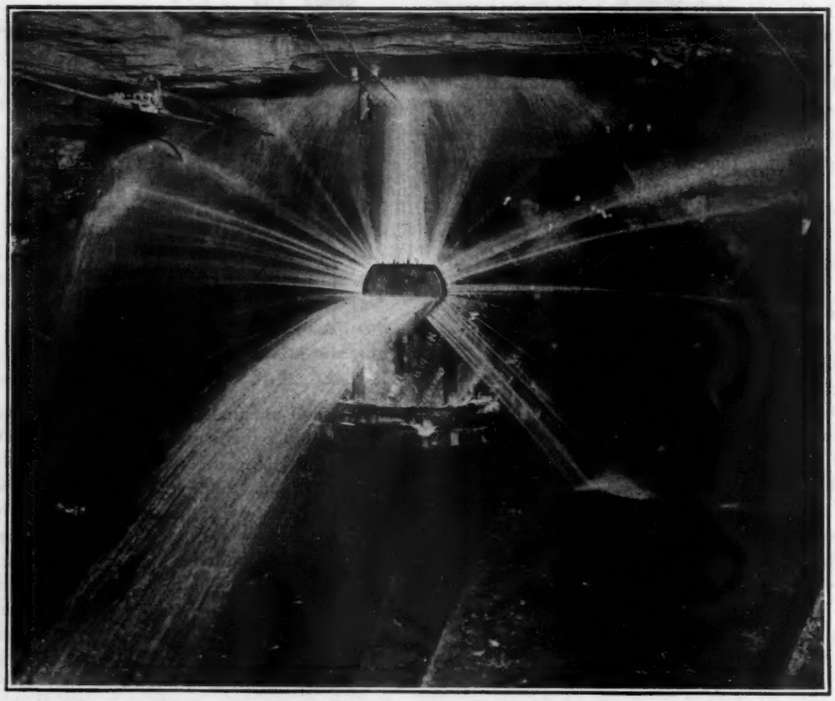
Rock tunnel and shaft work were never considered as anything but a task for pneumatic rock drills. In the mine, however, there are many lighter duty drilling jobs for which it was at one time thought that electric drills could be advantageously employed. The thought was to concentrate on electric equipment and to eliminate compressed air to a large extent. Now it is frankly admitted that the compressed air operated, hand-hammer drill is a so much more effective device that it is an absolutely necessary part of mine equipment.

Facing this situation, many operators have made the wise decision to install modern and efficient air compressors and to provide the requisite air power at low cost. One such operator is the United States Coal & Coke Co. It has recently developed and equipped one of the largest and most up-to-date coal mining operations in Kentucky, the mine being situated at Lynch, in Harlan County. This company has made some fifteen mine openings on their property, and is producing about 5,000 tons per day. This output is now being handled over a temporary tipple, but with the completion of the large central tipple now building, it is expected that there will have been enough mine development to begin loading 10,000 tons per day.

This company has installed, as part of its central power plant equipment, two sixteen-inch stroke Ingersoll-Rand "Imperial Type XPV" air compressors, with cross compound steam cylinders and two-stage air cylinders. Each machine has a piston displacement of 1,260 cubic feet per minute, and compresses to a final discharge pressure of 100 pounds per square inch. These machines are fitted with piston steam valves, and an oil governor which automatically varies the point of cut-off with changing air demand. Machines of this type are able to operate with high pressure steam and superheat, in the case of this particular installation 200-pound pressure and 100 degrees superheat. This works to excellent advantage in permitting the air compressor units to operate at the same boiler pressure as the main turbo generator equipment in the power house. One of the two compressors is now in operation while the second is about ready to start up.

Air from the central air plant is piped to the main workings of the mine and to various points throughout the surface plant. Among the interesting applications of pneumatic power above ground is its use in connection with the operating of an air controlled, rotary, mine car dump at the new central, or main tipple, over which all the coal from the mines will be handled in the near future. Two rotary dumps are planned, each of a capacity of two mine cars at one time. In operation, these will dump about twelve cars per minute and handle 2,000 tons per hour. The air control mechanism is simplicity itself, a single lever operated by one man.

Compressed air is used also for pumping water from deep wells, a supply which will be used for domestic purposes as well as sup-



The pneumatic sprinkler car in action

Truck-mounted sprinkler tank coupled to mine car compressor

*Reproduced by courtesy of Coal Industry.

plying the mine plant. The company installed the air-lift system as the most practical and least troublesome method of lifting underground water. At this time there are nine wells, drilled at various places around the plant, all piped from the central air plant and individually controlled. The water as it rises from the wells is discharged into a closed chamber at the well head, and flows by gravity into a common reservoir. From the latter it is pumped to an elevated tank which maintains the requisite pressure on the main pipe lines. The equipment is expected to deliver 12,000 gallons per minute when pumping to capacity, an ample supply.

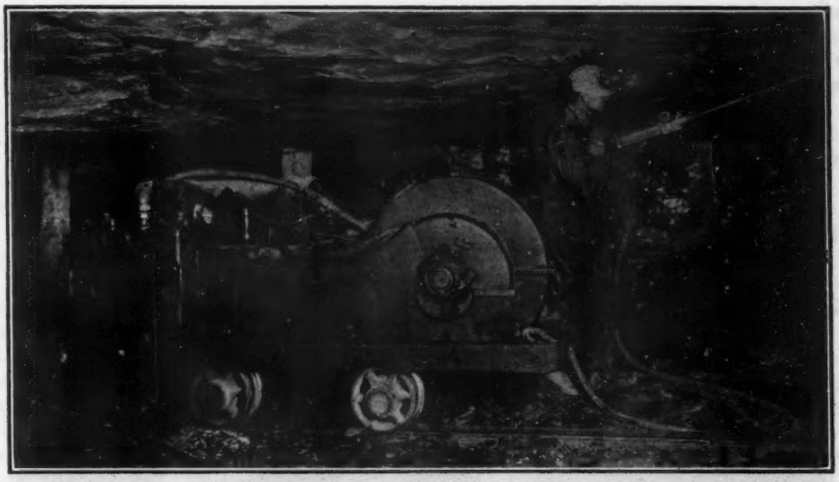
In the mines, the main demand for air is in the operating of jackhamer drills. These little hand tools are used for a great variety of rock drilling jobs, embracing almost every duty to which such a tool may be used. Much of the work consists in drilling sandstone roof in the main entries, drilling bottom rock and in overcast work. For this work, the light weight of the jackhamer makes it perfectly feasible to operate the drill while holding it by hand. Where a great deal of up-hole drilling is to be done, however, it is convenient to clamp the drill in a feed-shell mounting, and operate from a light tripod or column set up. In drilling roof, the holes usually average six to eight feet in depth and require ten to fifteen minutes drilling time.

In contrast to common practice in many mines, jackhamers are not used here for shot hole work. Since this is the case only hollow hexagon drill steel is employed.

For use in workings into which the permanent air lines do not extend, the company employs electric motor-driven, portable mine car compressors of Ingersoll-Rand make. There are seven of these units in the mines, all of which are used to supply power to jackhamer drills.

These portable compressors are compact and are easily taken wherever mine track has been laid. Hopper cooling of the air compressing cylinders obviates the need of water tanks and circulating pumps. Herringbone-gear drive is standard on machines of this type. The operating power is drawn from the trolley wire, a connection being made wherever the air may be wanted.

Rock tunnel development work with a mounted jackhamer



Mine-car compressor and jackhamer in operation

Pneumatic tools at work in the shop repairing mine cars

In connection with the use of mine-car compressors, an application developed in the adjoining mines of the Wisconsin Steel Co., is worthy of note. In addition to the usual operation of jackhamers, this company has found the mine-car compressor outfit of distinct advantage for sprinkling main entries and haulage ways for the purpose of keeping down the dust. They have constructed a sprinkler tank mounted on a mine car truck, which is coupled to the mine-car compressor, both being pushed through the entry or around the mine by motor. The sprinkler water tank is approximately 36 inches in diameter and twelve feet in length, and has a capacity of 600 gallons. Needless to say, the function of the compressor is to maintain pressure on the water tank to force the water through the spray nozzle. The illustrations herewith show how effectively this wets down the entire haulage way. Sprinkling is usually done at an interval between shifts when it will not interfere with production. The frequency of sprinkling is determined by the amount of dust in the entry, usually a weekly wetting is sufficient.

One further use of pneumatic power by the United States Coal & Coke Company is the operating of the many "Little David" air-drills, reamers, chipping and riveting hammers employed in the building and repairing of mine cars in the company's modern machine and forging shop. These tools are also called into play wherever structural steel erection is undertaken about the plant.

Drilling top with jackhamers in feed shell mounting on tripod

The last, but by no means least important application of air is in the operation of a Leyner jacksteel sharpener in the blacksmith shop. This compact mechanical forging machine makes and resharpens the bits on jackhamer steel and forms the shank and collar. The company is fully satisfied that mechanical sharpening is in every way to be preferred to hand blacksmithing. It is estimated that the sharpener saves fully half the labor which would otherwise be needed in the blacksmith shop.

In the preparation of the foregoing plant description the writer is indebted to Mr. E. O'Toole, general superintendent for the company; Mr. Albert, superintendent, and to Mr. A. P. Spear of the Ingersoll-Sergeant Drill Co., Knoxville, Tenn., whose coöperation and assistance are hereby acknowledged.

CERTAIN DISADVANTAGES OF THE VACUUM BRAKE

The railways of Europe during the present period are giving serious consideration to the adoption of a good type of continuous brakes for freight trains. The following, an abstract of a paper by A. Fuhr in *Annalen fur Gewerbe und Bauwesen*, is a contribution to the current discussion.

It is stated at the outset that one of the inherent objections to the vacuum brake is that of the low working pressure, which does not generally amount to more than 14 in. of mercury, while pressure brakes operate with pressure six to ten times greater. The low pressure of the vacuum brake requires heavy and bulky machinery where the system is used. For instance, one pressure brake with a twelve-inch diameter cylinder and an air receiver of two cubic feet capacity, was found to produce the same effect as two vacuum brakes each with a 21-in. cylinder and an air receiver of 19-cu. ft. capacity. Modern steel cars weighing 30 to 35 tons when empty require three to four such vacuum brakes. For instance, the mechanism on a car with four axles fitted with Westinghouse pressure brake weighs 116 lb. including the transmission rod and return spring, while on a car with two vacuum brakes, with 21-in. diameter cylinders, levers, plummer blocks, supports, and other working parts it weighs half a ton, or 1,120 lb. The greater weight, therefore, means more expense.

Another disadvantage of the vacuum system is that leakage in the pipe system causes a constant inflow of air charged with dust, soot, oil, moisture, etc. This occurs regularly when the locomotive is changed, and the valves and fittings therefore become choked and work badly, while the pressure brake remains clean much longer, as any grit or moisture which may be drawn in through the air-compressor is deposited in the main air receiver and does not reach the brake valves. The number of hose pipes required with the vacuum brake is greater than that required for the pressure brake, as each passenger car fitted with reversing vacuum brakes requires five separate pipes, which must all be reinforced against collapse, while the pressure brake only needs one.

The low pressure is disadvantageous, as it is all but impossible to keep the large bore pipes and fittings tight. They are considered satisfactory according to Austrian regulations when the fall of pressure does not exceed two and one-half inches of mercury per minute. The standard vacuum of fourteen inches of mercury is thus reduced to seven inches in two and one-half minutes; that is to say, the vacuum brake is very sensitive to the slightest extra leakage, while the pressure brake is still quite effective if the air pressure from some exceptional reason should sink to half the standard pressure.

Expansion of air in the vacuum brake also produces a low temperature, and there is consequently a tendency to freeze up and likelihood of disturbance to traffic, especially in northern latitudes. During the severe winter 1916-1917 this tendency became almost a calamity in Sweden, as there were almost daily delays of eight to ten hours in the Lulea-Stockholm train service, exclusively owing to the vacuum brake. It was found necessary on the iron ore line Lulea, Riksgrandsen-Narvic to remove the vacuum brakes and refit with pressure brakes.

Mr. Fuhr further states that the alleged greater simplicity of the vacuum brake has not been borne out in practice, owing to the cocks at the couplings, which are necessary for vacuum brakes, being troublesome, repairs difficult, readjustments frequent, and that the distance in which a train can be stopped is approximately the same as with a pressure brake.

According to tests carried out on the Prussian lines, the steam consumption of the vacuum brake is very considerable, and at least twice as high as that for similar trains fitted with pressure brakes.

On January 3, at Yuma, Arizona, the sun took a day off for the first time in 45 years. Rain fell for twelve hours straight, and a hotel which displays a large sign offering free board and gasoline every day that the sun doesn't shine, made a record for itself.

A huge Faucault pendulum, suspended from the roof to the first floor to demonstrate the rotation of the earth, is one of the most interesting pieces of apparatus to be seen in the new automatic museum recently equipped for the physics department of the University of Wisconsin. The pendulum is set swinging every morning at 8 o'clock, and the time of day may be read on the graduated circle followed, nearly in contact, by the point.

Cement Gun Used to Save Sea Water Piling

THE PILING of the water-front trestle in the Bellingham Division of the Puget Sound Traction, Light and Power Company has recently been treated by the gunite process for the double purpose of strengthening it and for preventing its destrtuction by the persistent salt water organisms.

The undertaking as a whole was of such magnitude as to warrant careful preparation. A train of three flat cars was provided, carrying first the bin for the sand and the sacks of cement, then the boxed-in motor for the mixer

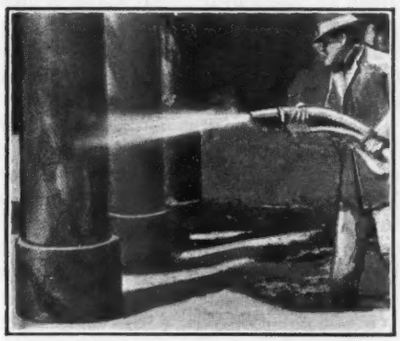


Figure 1—Applying the Gunite

and, successively, the cement gun, the motor driven air compressor, the fresh water reservoir and the water-pressure tank.

The operations are described in detail by Harry B. Sewall in *The Stone and Webster Journal*. It takes about eight men to handle the outfit, including the motorman and the conductor of the train. The motorman handles the sand and the conductor operates the cement-gun. Two men are needed to place the sand and cement in the mixer, with one part of cement and three parts of sand, and one man takes the mixture away from the mixer and places it in the gun, one man being used to operate the gun itself. One other man is needed to look out for the machinery and as a helper. On account of the condition of the bed of the Sound, which oftentimes is from one to two feet deep, three men are needed on the ground to handle the hose and nozzle. The nozzle itself is not difficult to handle, except that it is very tiresome work, and it is necessary to change the nozzle men more frequently.

The mixture is placed in the upper cylinder of the gun, the valve closed, air let into the cylinder valve open to the lower cylinder, and the mixture drops into this cylinder by gravity, the valve again being closed, and it is then fed into the hose at 28 pounds pressure by a small air-motor. The hose is made with a soft rubber lining and will expand, but shows no erosion from the sharp sand, mixed with cement, which is forced through in dry form. The other hose carries the water to the nozzle at a pressure of 38 pounds and the two are mixed at the nozzle. The theory is that the cement and sand mixture strikes the pile first and is driven in under pressure, and as the other particles of cement and sand are forced on top of this, driven in further with a certain rebounding action of the sand, which loses about 25 per cent. of it, none of the cement, however, being wasted. The mixture can be brought up very rapidly, and it is claimed by the makers that a flat surface seven by ten feet can be covered by two inches of cement in an hour. In using it in this way it is advisable to use some sort of reinforcing such as metal lath or chicken wire.

Many of the piles were concreted around the base in 1915, and while the greater part of this work has stood, some of it had to be replaced. The difficulty was not so much with its permanency as in the fact that the limnoria, a small boring crustacean, works up to high-water mark, and similar reinforcing to a point above this mark would have been very expensive.

Considerable work was done on the piling the early part of the season by adzing off the portion attacked by the limnoria, with the expectation of painting with cement mixed with the use of a brush. This was tried last year and was fairly satisfactory, although some of this very thin coating cracked off, probably due to the fact that it was not imbedded in the pile the same as is the case with the present operation.

In guniting the piles this time the material has been put on varying in thickness from a heavy coat of paint to eight inches, depending upon the condition of the pile itself. Where there were any large holes in the piling which had been eaten out by the limnoria, chicken wire reinforcement was tacked on and the piling brought up to its original size. All piling has also been treated to a point just above the high-water mark, or as high as the piling has been affected.

So far the work appears to be permanent after having set for about seven days, and it is almost impossible to break off the thinnest concrete coat with a hammer, and then only after continuous pounding. It is of note

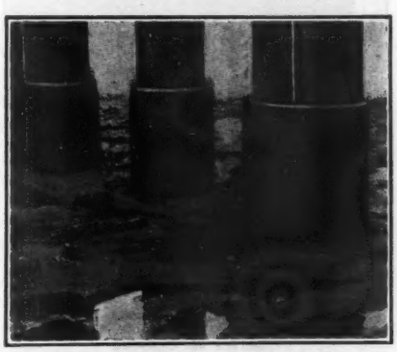


Figure 2—The Piles after Coating

that this gunite is absolutely impervious to water and differs from concrete in density, every void having been filled.

The work now completed has been necessarily slow on account of the condition of the tides and the necessity of clearing passenger- and freight-trains. Had this method of treating piling been known no money should have been expended during the early part of the season in adzing the piling, as the action of this mixture under high pressure on the affected piling kills all of the limnoria, and, if anything, adds to the permanency of the coating by the honeycombed condition of the piling.

The length of time necessary to treat each pile varies very considerably on account of the length and condition of the piles. The best record was the treating of 72 piles in 75 minutes, although these were the shorter piling and least affected.

FLIGHT ALTITUDE LIMITED BY ENGINE POWER

The height which an airplane may be able to reach under normal atmospheric conditions has been carefully computed. The power required is inversely as the square root of the density of the air at any altitude. Thus, assuming the sea level density or weight of the air is one, at an altitude of 18,100 feet it is only 0.50. Then, if the ascertained power required to sustain the airplane be assumed also to be one that required at 18,100 feet is $1 \div \sqrt{0.50} = 1.414$. But at the same time that the power required to sustain the plane has increased 41.4 per cent., the maximum power of the engine has decreased 50 per cent. The excess of engine power over the sea-level requirement is therefore the determining condition. Superchargers to increase the density of the air used by the engine may prevent the diminution of available power with increase of altitude.

OLDEST ENGINEMAN DEAD

The recent death of Garret Iseman, the oldest locomotive driver of the Erie Railroad, brings into retrospection, the development of the railroad and the subsequent prosperity of the United States. Mr. Iseman was born in 1824, there being no railroad in America at that time and when he was five years of age, Horatio Allen ran the *Stoutbridge Lion*, the first locomotive on this continent on the Delaware & Hudson.

When 21 years old, Mr. Iseman left his home on a farm and spent the ensuing 40 years in the cab of an engine on the Erie railroad. At the time of his venturing forth into his new occupation, there were only five wood burning locomotives on the Erie and he was made fireman on one of them. Mr. Iseman later witnessed the adoption of the air brake and the perfecting of this device, which did much to increase the efficiency of the railroad and expand its usefulness in serving the needs of industry. Mr. Iseman's experience included the days of the Drew-Fiske-Gould regime and he enjoyed the personal acquaintance of "Jim" Fiske, who frequently rode with him in his cab.

Casein glues are exceedingly resistant to the action of water, and retain a high percentage of their original strength even after long immersion under water. Water-proof glues have been developed primarily for aircraft purposes. Information on casein glues and their application may be obtained from the Forest Products Laboratory of the United States Forest Service, Madison, Wis.

An Honest Day's Work for an Honest Day's Pay

By CHARLES M. SCHWAB

THE FOLLOWING excerpt is taken from an address delivered at the dinner of the American Institute of Mining and Metallurgical Engineers in the course of its Chicago meeting. Mr. Schwab's summing up of the general worldwide situation and his cure for the high cost of living and industrial unrest must meet with universal approval. He strikes squarely at the roots of the evils and deals with the subject in his characteristic direct and forcible manner.

THE ENGINEERS have placed this great country of ours in a preëminent position with everything pertaining to manufacture, metallurgy, and the kindred arts. We are second to none in the world. We have a country which, another speaker has said, God has endowed with such riches in coal and natural resources as no other country in the world. But rich as these are, there is one thing greater; the sturdy character, energy, and integrity of its people, which will make these great resources an influence in the world's development.

Great as are these resources and the energy and integrity of our people, there is one problem of our engineering, which I term human engineering, that is of far more importance than the creation of machines and methods, with which you have been so successful in the past. Of what value is skillfully devised machinery or a complex process, unless manned and operated by people whose heart and soul are in sympathy with the work they are doing and who have before them the giving of a complete day's work for a day's pay?

I have often heard of this so-called German efficiency. Has this thought ever occurred to you? I have often thought of it while visiting their country. Germany is the second largest steel-producing country in the world, second only to the United States, and yet with all of its production and ability and development there has not been a single great invention or process in the development of iron and steel that has come out of Germany. What is the reason for this so-called efficiency? I think the basis of it is the giving of an honest day's work for an honest day's pay and when we teach, through our engineering ability and our methods, that the prosperity of the whole country, whether for capitalist or workman, depends on doing an honest day's work for an honest day's pay, all these theoretical questions of the high cost of living will naturally disappear.

I am not at all in favor of artificial methods of reducing the cost of living. There is but one way to do it and that is by economy, industry and efficiency. When we get this throughout our establishments, the high costs of living will, by the natural laws of industry, adjust themselves to their proper places and, therefore, you, the engineers of the country, who have done so much for the development of our country, it seems to me, must face a new problem.

A member of our society who has just passed away, Mr. Carnegie, was one of the greatest captains of industry, one of the great developers of industry in this country, and yet he wasn't a technical man nor had he skill in the arts which he so greatly developed. But, that quality of human engineering enabled him to draw about him a set of men who have given their best on all occasions. He always believed in approval and never in criticism, and I have yet to find the man worth while in any station of life who does not always give his best efforts under the spirit of approval. The spirit of encouragement will always develop the best that is in any of us. You, the engineers of this country, have this to face because, after all, the great establishments of industry depend on the engineers. Often, in my manufacturing establishments, I carry about a man of technical ability, if he has within him the qualities that make men believe in his leadership, his honesty, and the pursuit and development of his work. It seems to me that you, the engineers of this country, have this new branch before you in which a greater good can be done to the country in this reconstructive development than by all the technical inventions and processes you can devise because it is a greater and more lasting question.

(C) Underwood & Underwood, N. Y. City.

Charles M. Schwab

We have won the greatest war and we must not lose advantage of the lesson that we have learned by reason of it. That lesson is, broadly, one that the President proclaimed as the lesson of Democracy, not in the ordinary sense of the term, but a Democracy that will teach us that men are men for what they are.

The aristocratic man is not the man of birth and he never will be. The aristocrat of the future is the man that will do something worth while for his fellow man and his country. That is the basis upon which we all stand, for the future and honorable career of the man who is going to be an aristocrat among his fellow men in this country will depend upon his doing something that is worth while for his fellow men. No one at this day, can do more for the good of his fellow man than the human engineer who will teach men that the best interests of themselves and the best interests of the country lie in the development of the country's energy and honesty in all its industrial pursuits.

DEVELOPMENT OF MR. FORD'S NEW STREET CAR

Charles E. Sorensen, Chief Engineer for Messrs. Henry Ford & Son, Inc., writes COMPRESSED AIR MAGAZINE from Dearborn, Mich., that work is still going on apace in the development of the Ford experimental street car to be propelled by an alcohol or kerosene gas motor, which was described editorially in the January issue. "This is an entirely new phase of internal combustion work," writes Mr. Sorensen, and one that requires a great deal of experiment and research."

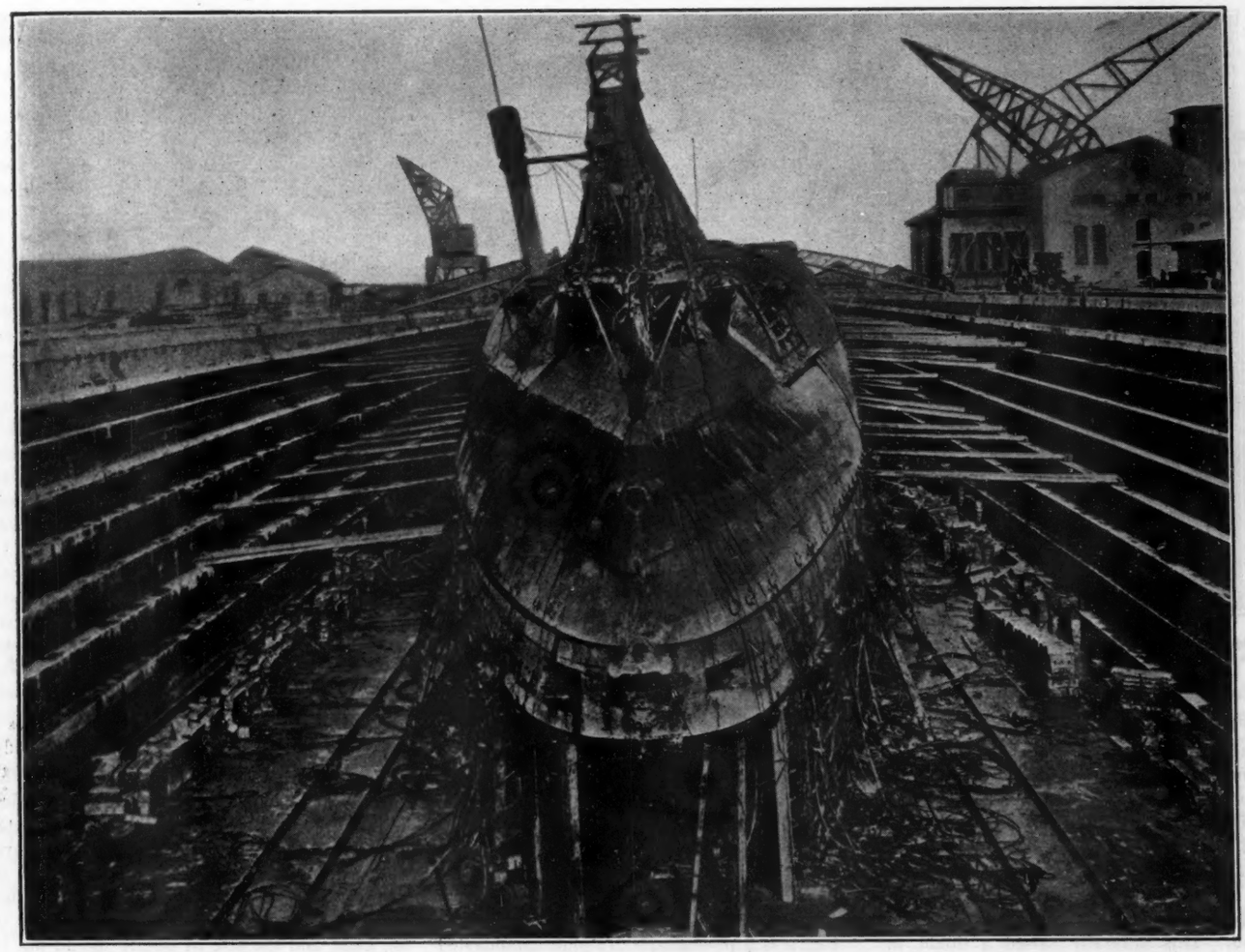
Mr. Ford himself advises that the first experimental car is now being assembled. He expects to use alcohol as fuel for the motors, and is extracting alcohol from straw. Mr. Ford's street car motor has four cylinders, double opposed horizontally, and, mounted on ball bearings throughout, it gives 75 horse power. Light and compact it will obviate wasteful pounding of rails.

The 75 h. p. motor is to be tested on the street railway lines of Detroit. There is another 150 h. p. motor which will be tested on the Michigan Central railroad. This heavier motor has the accompaniment of an electric starter and an air compressor.

Leaf springs will be used on the car's double trucks, which are especially designed for the new motor beneath the floor of the car, control by the motorman being from the vestibule, as is the case in conventional trolley cars.

Meantime Henry Ford & Son are going

Raising a Sunken Battle Cruiser by Compressed Air



(C) International Film Service, N. Y. City.

The salvaged battleship "Leonardo da Vinci," sunk by an internal explosion being supported on the masonry drydock after having been refloated from the bottom of the harbor of Taranto. The ship "turned turtle" after the explosion and is shown bottom up, the position in which she was refloated.

ON AUGUST 1, 1916, the 24,000 ton battle cruiser *Leonardo da Vinci* was the pride of the Italian navy. On August 2 her status was suddenly transformed and she was on her way to the condition and position here shown. There was an explosion of the magazine and in the act of sinking she turned completely over, carrying down 21 officers and 221 men. The occurrence was at first assumed to have been an accident, but investigaton showed the guilty responsibility of two employes of the arsenal, and they were immediately shot.

But there she lay, her turrets burrowing in the mud and her keel just showing above the surface, not only worthless for either offense or defense, but a serious obstruction of the harbor of Taranto, and the first thought was to remove the remains, piecemeal or otherwise, rather than to attempt to save this fine fighting ship as a complete fabric.

Even this way out of the trouble, however, when it came to be considered in detail, seemed to involve so many difficulties and dangers that it was finally determined to raise the hull entire, the plan as worked out by the Italian engineers proving to be practically a compressed air stunt all through.

First there was to be no attempt to right the ship, but to float and move it upside down as it was. By strenuous and persistent work divers dismantled the guns under water, released and removed the great turrets and the great tangle of wreckage caused by the explosion. The holes in the hull were patched temporarily and compressed air was forced in, displacing the water downward. The body of the ship was thus converted into a great pneumatic caisson in which men of the sand hog type could work and assist in lightening the craft. After a year's unparalled toil the weight of the wreck was thus reduced from 24,000 to 18,000 tons. Then with the additional lifting power of eight pontoons of 400 tons each the cruiser was pulled out of the mud and floated free, the pontoons serving to maintain the equilibrium of the mass in its passage to the drydock.

The docking involved its own special difficulties which need not be particularized here, as we see the ship in the picture safe and secure with the water withdrawn and every part accessible. When the hull is completely repaired and the deck made water tight, the ship will be towed into deep water and by means of lateral displacement of weights and internal flooding restored to an upright position.

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ahead with plans for quantity production. Inquiries are pouring in from street railway and interurban lines throughout the country, asking when the new cars will be ready and inquiring for operating and price data. Mr. Sorensen says the company will have a plant two miles long in Dearborn to build these cars. They will weigh only ten tons, compared to 35 tons, the weight of the standard interurban car now in use. The car will largely reduce operating costs, it is declared, though it will have a speed of 70 miles an hour.

Best Quality and Size of Sand for Sand Blasting Before Painting

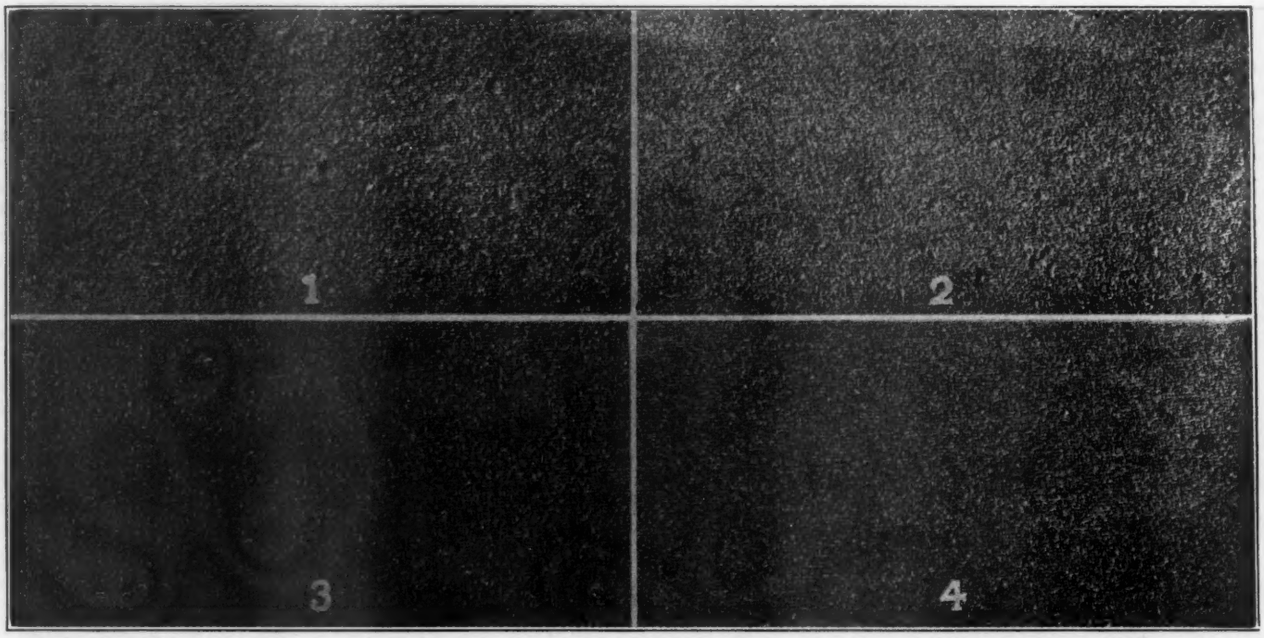


Fig. 1 shows a steel plate sandblasted with sand run through a 4 by 4 mesh sieve. Fig. 2 shows a plate treated with sand run through a 6 by 6 mesh sieve. Fig. 3, plate blasted with sand passed through a 10 by 10 mesh sieve. Fig. 4 is a plate sandblasted with sand run through a 16 by 16 mesh sieve.

*By J. W. GIBBONS**

EXPERIENCE having taught us that the sandblast is the most economical and thorough method of removing the flash scale corrosion and old paint from a metal surface, economy of operation has been the only thing considered, durability or cost of finishing the surface has been lost sight of, with the result that a surface which was practically impossible to preserve with paint, has frequently been obtained. This naturally raised a doubt in the minds of some as to the desirability of using a sandblast in preparing a metal surface for paint. Even in conventions of this association, the durability of paint applied over a sandblasted surface compared to a non-sandblasted surface has been questioned. This state of affairs has held particularly true with regard to steel roofs.

The above facts, no doubt, prompted the committee in their selection of the above question for discussion. In my opinion, the essentials necessary to secure good results from sandblasting metal preparatory to painting, are the quality and size of the sand pebbles and the velocity and volume of the projectiles thrown against the surface. As to quality, any sand that is hard and firm will answer. The less dust or dirt it contains the better from every point of view. As to the size of the sand pebbles, I submit four photographs to show the results secured with various sizes.

A photograph of a steel plate sandblasted with sand run through a 4 by 4 mesh sieve is shown in Fig. 1. Note the torn condition of the metal; the pin points are numerous. When paint is applied over a surface like this and subjected to the attrition of wind, rain, sleet and cinders, incident to service conditions, the sharp projections puncture the paint film, allowing moisture to seep under the paint, carrying with it all the destructive agencies of the sulphurous products from coal burning locomotives or furnaces. Corrosion sets in, deteriorates and frequently destroys the metal before we realize that anything is wrong.

Fig. 2 is a photograph of a plate sandblasted with sand run through a 6 by 6 mesh sieve and is practically as poor a surface to paint over as that shown in Fig. 1. A photograph of a plate sandblasted with sand run through a 10 by 10 mesh sieve is shown in Fig. 3, while Fig. 4 shows a plate sandblasted with sand run through a 16 by 16 mesh sieve. Figs. 3 and 4 present an ideal surface for paint with just sufficient roughness to give tooth to the paint and hold it firm and solid.

These plates were all cut from the same piece of sheet steel and sandblasted with the same quality of sand. The velocity and volume of projectiles was also the same on all plates, the only difference was in the size of the sand pebble and, in my opinion, proves that the size of pebble enters largely into the results obtained by sandblasting.

The second part of my claim, that the velocity and volume of the projectiles also are essential, may not be as susceptible of proof by photographs, but if you take a sheet of steel and throw a heavy volume of sand upon it with a high velocity, you will find that it will not only tear the metal, but will warp the sheet.

When we consider that sand run through a 16 by 16 mesh sieve will clean practically as much surface in a day as sand run through a 6 by 6 mesh, and that the only extra cost is in the time required to sift the sand and in the percent of sand available, and that this extra cost is more than made up in the time required to paint and surface up the metal, there can be no excuse for using a coarse grade of sand. As to velocity and volume of projectiles, in my judgment, the air pressure should be not less than 70 nor more than 90 lb., gage, and the size of nozzle should not be over 3/8 in. nor less than 1/4 in. in diameter. To secure durability of paint surface and the proper protection of metal, the character of surface obtained by the sandblast is as essential as the quality of paint applied.

*Foreman Locomotive Painter, A. T. & F. S. R. R., Topeka, Kan., who delivered his paper before the Master Car and Locomotive Painters' Association, Chicago.

The delivery of parts and accessories for automobile trucks to the owners of these machines in the oil fields of Texas will be by airplane from Dallas, and the Keith-Patterson Motor Company, state distributors for the Republic truck, already has its air equipment in service. It is pointed out that an idle truck in the oil fields costs its owner $40 a day, and he therefore cannot afford to have it remain idle because of some slight break in parts. The distributing company is prepared to answer wires for parts by sending such parts by the air route. This is calculated to reduce what might be a two days' delay to two hours.

One of the famous English windmills that has figured in art and literature is at Brixton Hill. Built long ago, it has remained in the possession of one family for 120 years. All of which is preliminary to the statement that the mill is now run by electricity. The "juice" costs more than the wind did, but it is more reliable.

An Improvement in Rotary Compressors*

THE ADVANTAGES of the turbo compressor over machines of the reciprocating piston type, as far as reduction in initial cost, saving in floor space and foundations, attention and maintenance are concerned are sufficiently well known. The principal drawback of the turbo compressor, however, is the difficulty of adapting it to comparatively small volumes, and from a commercial point of view there is a fairly well defined minimum volume and maximum pressure at which it ceases to have any advantage over the reciprocating machine. This minimum volume may be fixed at about 2,000 cubic feet of air per minute, with a corresponding maximum delivery pressure of, say, ten pounds per square inch.

It is, of course, possible to design turbo compressors for smaller volumes, provided the delivery pressure is less than ten pounds, but the initial cost of such a plant compares unfavorably with other types. With the object of producing a compressor of relatively small capacity at a moderate price Reavell & Co., Limited, of Ranelagh Works, Ipswich, have recently introduced and patented a new form of compressor for capacities from 100 up to 2,000 or 2,500 cubic feet per minute, which is designed to compress air up to ten pounds or fifteen pounds per square inch gage, and which at the same time may be run at a speed sufficiently high to allow of direct coupling to electric motors of standard speeds.

This new rotary compressor is of the familiar crescent type—that is to say, a drum, fitted with a number of slots in which steel blades slide in a radial direction, revolves in a casing in which it is placed eccentrically. In its simplest form, as is well known, the sliding blades press against the inner surface of the stator, owing to the action of centrifugal force which is set up by rotation. The great drawback to such an arrangement is that the pressure set up by the centrifugal force along the tips of the blades causes a great deal of friction, which results in excessive wear both to the blades and of the casing, and produces a considerable amount of heat by reason of the high rubbing speed along the inner surface of the stator. In consequence, machines of this type have usually to revolve at very low speeds, and this defect renders them unsuitable for a direct form of drive.

This difficulty has been overcome by Reavell & Co. in a very ingenious way, as shown in Figure 1.

Instead of being forced against the bore of the stationary casing the blades press against the interior of a liner, which revolves on ball bearings concentric with the casing. The outside diameter of the liner is slightly less than the bore of the casing, so as to leave a small clearance between the revolving and the stationary portions of the machine and thus to prevent any rubbing effect. When running the centrifugal force created in the blades forces them outwards against the liner, and the friction produced at the tip of the blades is obviously much more than sufficient to overcome the slight frictional resistance in the ball bearings. The liner therefore revolves freely with the drum or rotor.

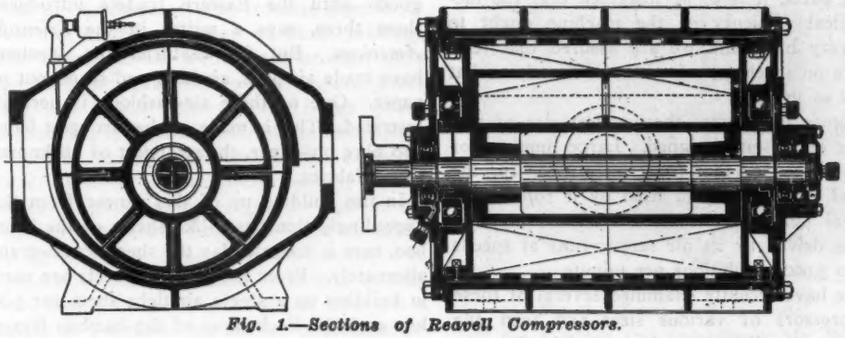


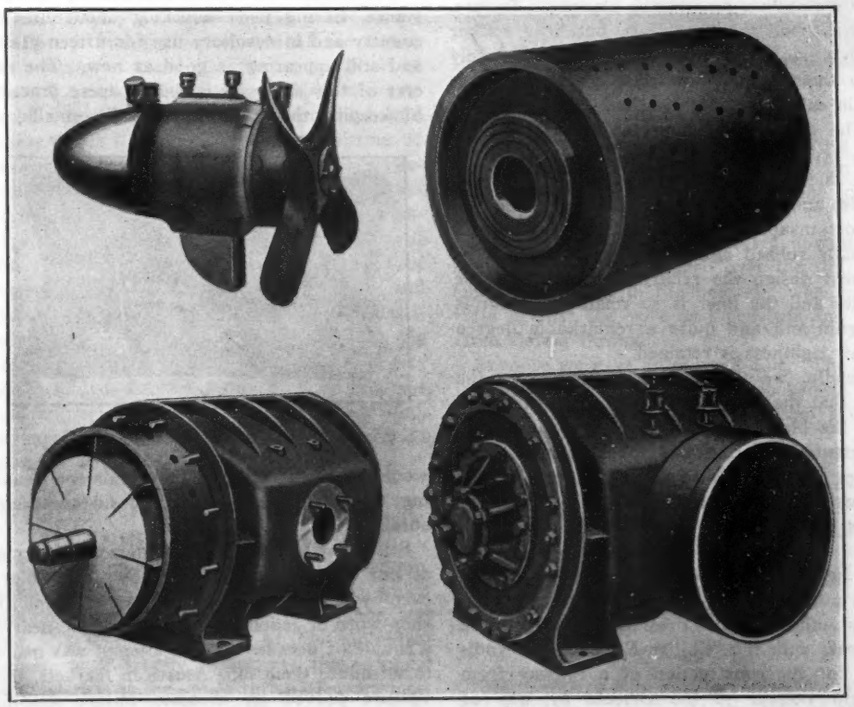
Fig. 1.—Sections of Reavell Compressors.

There is obviously a small amount of relative motion between the blades and the revolving liner, since the tip of a blade at the top of the crescent has a greater tangential velocity than the blade diametrically opposite. As a consequence, the liner, as experience has shown, takes up a certain mean speed, which inevitably leads to a slight relative motion between the blades and the liner, but this small movement is almost insignificant as compared with the surface speed of the blade tips if they were to rub against the wall of a stationary casing. This fact enables the normal speed of the machine to be raised very considerably, and thus renders it suitable for direct coupling to electric motors and other forms of high-speed engines.

In Figures three, four and five the construction is shown by a series of engravings reproduced from photographs. Figure three shows a liner with its end discs and ball bearing. It will be observed that it is freely pierced with holes to permit the ingress and egress of the air. Figure four shows a machine partly dismantled. The crescent-shaped space can be seen very clearly, as well as the blades pressing against the interior of the revolving liner. Figure five is an outside view of a complete machine fitted with a filter on the suction side.

This type of compressor has been standardized by the makers, and their list covers a range of volume from 50 to 2,500 cubic feet per minute. The speeds range from about 2,500 revolutions per minute in the case of the smallest down to about 400 revolutions per minute in the largest units. As already stated, the machines can be designed for pressures to fifteen pounds per square inch, and they can be made for higher pressures if necessary, but in that case water cooling is provided for.

In view of the fact that all bearings are



Figs. 2, 3, 4 and 5, Reavell Compressors.

*Abstract from The Engineer, London.

of the ball or roller type, and that, apart from the comparatively small amount of friction in the blades and drum, there are no other rubbing parts, it is to be imagined that the mechanical efficiency of the machine ought to be very high, and we are assured that tests made on machines of various sizes show that it is so in fact.

Figure two shows the smallest size of machine at present designed. Large numbers of compressors of that form were made for the Royal Air Force, and used by it for certain special purposes on aircraft. This tiny machine, driven by its air screw, runs at speeds up to 3,000 revolutions per minute.

We have recently examined several of these compressors of various sizes and seen one under test, and we were impressed by the very

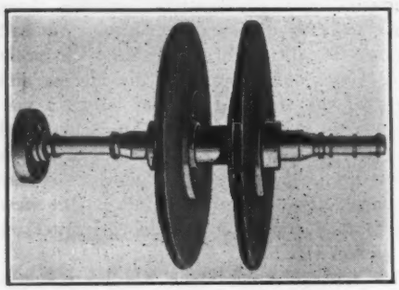


Fig. 6.—Rotor of Reavell Compressor.

high order of workmanship put into them. It would not be fair to the makers to say what the clearance between the liner and the stator is, but it is evident that it must be very small, for otherwise air would escape through the annulus. Combined with this exceedingly small clearance absolute circularity is essential. To obtain these two qualities in a thin cast iron shell is no easy matter, and we congratulate the makers on their achievement. We may allude also to the blades. They are, in the smaller size at least, but little thicker than a saw blade, yet must fit fairly accurately into their slots. First-class workmanship is again called for.

The general objection to all machines of this type is that tightness is dependent on the line contact between the ends of the blades and the cylinder walls. It presented an almost insuperable difficulty when the blades actually rubbed against the walls, but in the present design the relative movement of the blades and the liner is so small that wear is insignificant, and quite a remarkable degree of air tightness is retained.

Finally, we would direct attention to the fact that the end plates revolve with the liner and the blades, so that there is none of the differential wearing due to the varying distances from the centre which was experienced in early attempts to build rotary steam engines on these lines.

It has been reported from Quito, Equador, that a bill has passed both Houses of Congress authorizing the President to enter into a contract with the "Chilian-Ecuadorian" syndicate for the construction of a railway from Puerto Bolivar to the Oriente by way of Cuenca and Loja.

JAPANESE AIR CUSHIONS MADE OF PAPER

Nippon is a land which never had rubber goods until the Eastern traders introduced them there, says a writer in the *Scientific American*. But for centuries the Japanese have made air-bags, air-beds and so on out of paper. One of these air-cushions is here illustrated. This is made of the strongest bamboo fibre ply-paper, the strongest of all known paper fabrics.

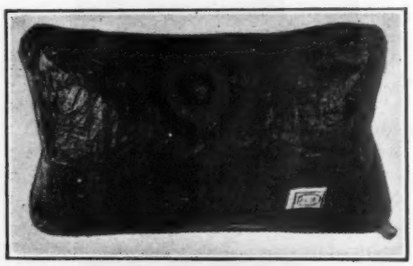
In the building up of this veneer from the exceedingly thin tissue-like sheets of the bamboo, care is taken to lay the sheets cross-grain alternately. From six to eight sheets are used in building up a single air-tight sheet for pillow or bed. Each layer of the bamboo flimsy receives an adhesive coating of flexible shellac cement, thus insuring absolute impermeability.

The air-cushion illustrated measures, flat, 28x38 centimetres (11x15 inches) and folds into a space small enough to fit the vest-pocket, occupying less room, in fact, than the average tobacco-pipe or cigar and holder. The color is the dull reddish hue of the shellac, both inside and out. There is no interior lining of another fabric; complete dependence is placed on the bamboo ply-paper.

What surprises one about the Nipponese air goods is their extreme lightness. For inflating the smaller articles the Japanese uses a short air pump made of a bamboo section about six inches long, easily portable in the pocket.

The air-cushions are very cheap, the one pictured here retailing for about half a dollar. In Japan, with the yen currency, it would fetch but half this price. No wonder the American-made rubber goods cannot drive these articles out of their home markets.

The Asiatic paper articles are very lasting —the one shown in the illustration, for instance, having been knocking about in this country and in desultory use for fifteen years, and still appearing as good as new. The secret of this longevity is the Japanese practice of keeping the cushions in a slip-on silk or



Air Cushion of Paper

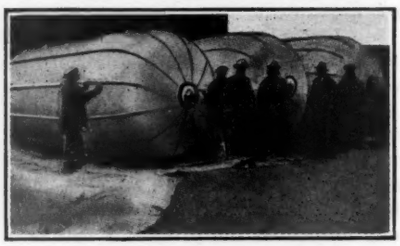
wool bag or cover, easily removable for cleaning, which saves the shellacked surface from abrasion.

Still, they do not look so showy or taking as our own rubber goods. Their dull color, even when new, gives the appearance of shop-worn or faded articles; and when, nearly a couple of decades ago, an attempt was made to introduce them into American markets, the venture proved an absolute failure despite their low price.

RAISING SHIPS BY USING INFLATED AIR BAGS

To raise a sunken vessel by filling the hold with air is a simple thing to think of, but to work it out in practical detail is another matter. Many ships have been so raised, but the story of the difficulties overcome has seldom been told. The matter is interestingly discussed in a recent issue of the *Scientific American*, from which the accompanying illustration is reproduced.

When air is introduced in large volume as a levitating agent it is not often that the deck of the ship will stand the lifting strain. Decks are built to bear a downward pressure only, and when the condition is reversed the deck is liable to be torn loose. In some cases the deck may be strengthened so that it will support this load without leakage of air. The



Air Bags for Raising Ships

air must be kept from collecting at one end of the vessel, otherwise the bow or stern might come up leaving the rest submerged. Usually the vessel has to be divided into compartments, and sufficient air introduced into the various compartments to bring it up on an even keel. This calls for a great deal of work on the part of the divers, which adds to the cost of salvage and in some cases makes it absolutely prohibitive. When the vessel is in an exposed place, storms are liable to interrupt the work at any moment, and operations that have consumed weeks may be destroyed inside of an hour.

In order to obviate under-water work as far as possible a new plan has been introduced of using canvas bags to confine the air in the hold of the vessel. The accompanying photograph shows a set of these canvas bags, three of which are inflated and give some idea of their size. The bags are about ten feet in diameter. They can be introduced into the hold in collapsed condition, and arranged under such portions of the deck as may be able to stand the upward strain. It is not necessary to repair any wounds in the vessel and the bags can be used even when the hull is broken near the main deck. After a sufficient number of bags have been introduced air is pumped into them and by varying the amount of air in the various bags, the vessel may be brought up evenly, after which it can be towed to a drydock and be repaired.

John H. Pardee, president of the American Electric Railway Association, has been at Manila, P. I., for the purpose of inspecting the Manila Electric Railway & Light Company and other interests of the J. G. White Management Corporation. He will return to New York in the near future.

CODE OF STANDARD DERRICK AND CRANE SIGNALS

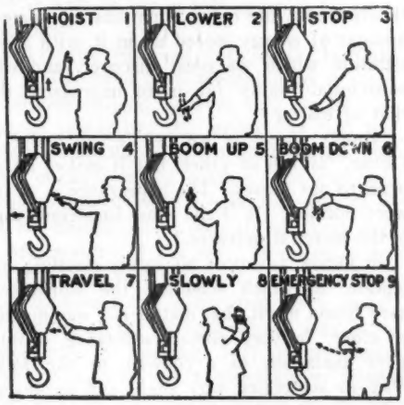
The signals grouped in the cut are in use on all construction work of the U. S. Reclamation Service for communication between groundsmen and the operators of derricks and locomotive cranes. Some of the signals are in almost universal use now and the others are equally simple and efficient and thus brought together they provide standard code which it would be well to adopt everywhere. The diagrams and the rules should be posted in conspicuous places about the work, and it should be distinctly specified who are authorized to use them.

1. HOIST—Forearm vertical. Make small horizontal circle with the hand.

2. LOWER—Arm extended, hand below hip, wave forearm downward.

3. STOP—Arm extended, hand level with the hip. Hold position rigidly.

4. SWING—BOOM AROUND—Arm extended, forefinger indicating direction of swing.



5. BOOM UP—Arm extended, fingers closed, thumb down, jerk arm upward.

6. BOOM DOWN—Arm extended, fingers closed, thumb down, jerk arm downward.

7. TRAVEL—Arm extended, hand open, wave forearm in direction of travel.

8. MAKE MOVEMENT SLOWLY—Left forearm vertical, hand open. Right forearm vertical, forefinger extended near left hand. Make small circle with right hand.

9. EMERGENCY STOP—Arm extended, hand open, palm down. Move hand quickly to right and left.

A PREHISTORIC PNEUMATIC INVENTION

[NOTE—Kindly observe the date. It surely is further back than where the history of modern compressed air practice is understood to begin. We print the story verbatim from an old magazine whose title cannot now be identified, but the date, 1839, is clearly given. The article was a reproduction, with full credit, from the *Birmingham* (England) *General Advertiser*.—THE EDITORS.]

"We were favored a few days since with an opportunity of visiting the extensive paperworks of Messrs. J. Evans and Co., at Alder Mills, near Tamworth, where we had the pleasure of witnessing the application of an ingenious and very beautiful piece of mechanism, the invention of the Messrs. Evans, to the printing of paper hangings, which cannot fail to produce a complete change in this department of our manufactures, from its superiority over the ordinary method of block printing. The Messrs. Evans would have brought their invention into practical operation many years ago, had it not been for the heavy duties imposed on the manufacture of stained papers, which, by limiting the consumption, rendered their invention comparatively useless; a fact which supplies another argument against the imposition of heavy duties upon the manufacturing skill and industry of the country. In connection with the present invention, we may here state that the Messrs. Evans took out a patent in February last for an important improvement in the manufacture of paper, by the application of a pneumatic pump in the compression of the moisture from the pulp, by which means the substance is almost instaneously converted into paper. By this invention they are, we understand, enabled to manufacture a continuous sheet of paper six feet in width, and nearly two thousand yards in length, every hour. This paper, as it is taken off the reel, is in every respect fit for immediate use, and is conveyed on rollers to another part of the mill, in which the printing machinery is erected, through which it is passed with great rapidity, and receives the impression of the pattern intended to be produced, with all the precision and beauty of finish which machinery can alone effect. In order to connect the operations of the paper-making and printing machines, the Messrs. Evans are at present engaged enlarging their premises; and when this alteration is completed, they will be enabled to print, glaze, and emboss the most complicated and delicate patterns in paper hangings, in every variety of shade or color, as rapidly as the paper can be manufactured. Some idea may be formed of the power of the machinery, and the importance of the invention, when we state that during our visit to the mill, the machinery was working at a rate which would produce sixteen hundred and eighty yards of paper per hour, consisting of two very beautiful patterns, the only hand labour employed being that of one man, who superintended the machinery, and four girls employed in rolling up the paper in pieces of the required length. The whole process of manufacturing the paper from the pulp, and impressing it with the most complicated patterns, is carried on within a comparatively small space, and with a precision and rapidity which affords another instance of the progress and triumph of science and mechanical skill in supplying the necessaries and comforts of civilized life."

MODEL FOR DRILL-ROUNDS HELPFUL TO STUDENTS

The placing of the drill-holes in driving, say, a tunnel heading is an operation which should be continually planned in advance, and not left to the judgment of the individual miner, as it largely determines the economy and celerity of the entire series of operations. The visualization of a drill round in all its three directions and dimensions is often difficult for a miner and accordingly Mr. Walter S. Weeks presents in a recent issue of *Mining and Scientific Press* a brief description of a simple practical working model which has proved its usefulness in the Mining Department of the University of California.

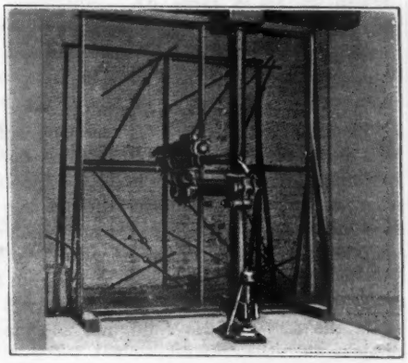


Fig. 1. Front view of model

The photographs here reproduced with the article are almost self-explanatory. Two frames are constructed as shown. The one nearer the machine represents the breast of the drift and the other represents the limit of the advance. The advance can be made any distance desired by moving the rear frame. These frames are covered with chicken-wire.

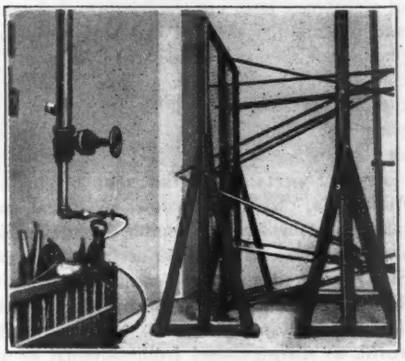


Fig. 2. Side view of model

The drill-holes are represented by rods of wood that can be rested in any position on the wire. They are held in place by the collar shown in Fig. 3.

Suppose we wish to represent a downward hole. The collar is slipped over the rod. A small nail is put in the hole *A*. The collar rests against the wire and prevents the rod from sliding through.

Suppose we have an upward hole. The nail is placed in *B*. The hook is hooked in the wire and the rod is thus kept from sliding back.

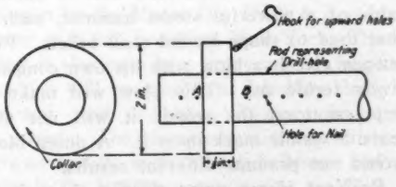


Fig. 3. The collar

These collars represent the actual collars of the drill-holes. Obviously any type of round can be illustrated.

How Substantial Are Terrestrial Air and Outward Ether?

By FRANCIS JUDSON TIETSORT

SIR OLIVER LODGE, in lecturing before a New York audience, commented on the limitations of the human senses, and illustrated how deceptive human perceptions may be by comparing the pounding of a table with one hand and the beating of the air with the other. The wood, he observed, was a sketchy and unsubstantial thing, with little reality to it, while the air was the solid and substantial thing!

Sir Oliver probably builded a better illustration for the non-philosophic mind than he knew, especially for very material persons, if material any of us are, although he was only earnestly endeavoring to indicate how human consciousness gives only a faint conception of the realities of the universe, separated from us, he says, by merely a thin veil. He calls the outer ether about the world a substantial thing, far more impressive than matter.

He is one of only many scientists who are trying to bring physics and the psychic closer together. There is coincidence in the very terms!

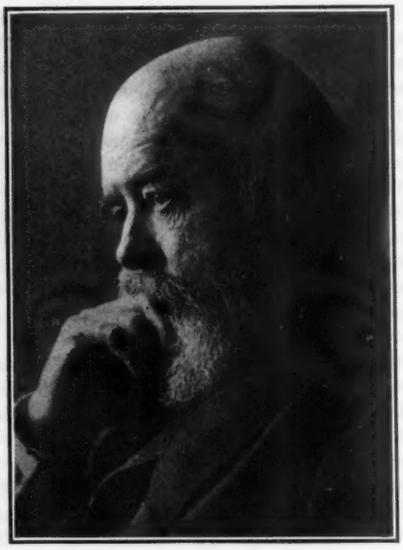
Physics, natural philosophy, or natural science, comprises the closely related sciences of mechanics, heat, electricity, light and sound, and is generally held to deal only with those phenomena of inanimate matter involving no changes in chemical composition. Motion is the most general and fundamental of all such phenomena, and physics is sometimes defined as the science of matter and motion.

Psychic pertains to the soul or to life. Adding "al" to it, it becomes psychical, pertaining to the living principle in human life, and sometimes, as might be used in discussing Sir Oliver's ideas and researches, pertains to the human soul or consciousness in its relation to sense, appetite, and the outer visible world, as distinguished from spiritual or rational faculties, which have to do with the supersensible world.

The interesting play on the two terms, or words, so nearly alike in spelling, but one defined as pertaining to material conceptions and the other to mental conceptions, brings point and focus to a consideration of Sir Oliver's highly interesting illustration in which he compared the pounding of wood and the beating of the air, which latter invisible element he called the more solid and substantial thing.

A—Suppose we take a small length of ordinary yellow pine board, as an illustration, and lay it before us on the steel base or hammer table of a powerful steam hammer, such as that used to shape heated steel billets. First let one give it a blow with his own comparatively feeble fist. This blow will make no impression on the wood; it will not even leave a visible mark upon it. A dozen blows would not produce different results.

B—Next if we swing the fist through the air in the same gesture and arc of blow, without touching the board, we have beaten that air in the path of the blow, but without any physical consciousness, in result, of having done so. For all one can detect through his senses, nothing has happened. There was nothing substantial or material impeding his blow. Repeated blows would make no difference.



(C) Int. Film Service, N. Y. City.
Sir Oliver Lodge

C—Now let the steam hammer take the place of the fist. The first mighty blow rends, smashes and pulverizes the wood. Repeated blows, if the debris is kept on top of the hammer table, reduce the wood to dust. What seemed so hard and impermeable to human touch, the impact of the fist, becomes as nothing.

D—Let us translate the steam hammer now into terms of an air compressor. The steam hammer, or piston of an air compressor, as it becomes, strikes the air through which one's fist has travelled without apparent result, as seen in "B," and backs up and packs the invisible and apparently intangible element into a plate steel receiver or powerful wrought steel bottle. Here, after repeated thrusts of the plunger or piston, the unsubstantial air becomes a mighty and very definite force, measurable at, let us say, from 75 pounds to 3,000 pounds of energy or force to the square inch. It is found capable of driving and actuating anything from tools to torpedoes.

So we have seen that what seemed to human touch or sense (as in "A") so real and material and substantial, came to be (as in "C") trifling and of no great solidity or consistency.

What seemed as nothing (in "B") becomes (in "D") a mighty force.

By means of rational thought or inventive faculty, mankind by a series of mental transactions has created the machine we call an air compressor, which makes a living thing of power out of the invisible and apparently unsubstantial element of air. The *psychic* has transformed the invisible, intangible thing into something which *physics* utilizes in common, everyday practice, as being ordinary and matter-of-fact!

Eureka! Sir Oliver would therefore appear to prove his case from both material and *ethereal* (!) standards.

And speaking of ether, all of science seems to be groping out into it these days. The Clark College professor's plan to explore the ether with a recording rocket, which we discuss elsewhere editorially, is an indication of the trend. It may not all be so "absurd" as it sounds to some of the prosaic lay brethren.

Sir Oliver Lodge, who, nobody will gainsay, is a distinguished scientist, declares flat-footedly that to his mind the ether of space is a substantial reality with extraordinarily perfect properties. Who are air compressing machinery men, for instance, to deny Sir Oliver's theorem that the outer ether has an immense amount of energy stored up in it, with a constitution which we must discover, and of a substantial reality far more impressive than that of matter?

"Empty space, as we call it," to quote Sir Oliver, "is full of ether, but it makes no appeael to our senses. The appearance is as if it were nothing. It is the most important thing in the material universe."

Sir Oliver advances his rather startling conception, in which scientists the world over have found merit, that matter is a modification of ether, "a very porous substance, a thing more analagous to a cobweb, or the Milky Way, or something very slight and unsubstantial, as compared with ether."

Dr. Einstein and his associates in belief respecting relativity, according to Sir Oliver, do not deny ether. At present they simply ignore it for the excellent reason that it is not subject to experimentation. The visiting British scientist predicts that in twenty years the Einstein adherents will find, scientifically speaking, that they cannot do without ether.

The latter prophecy brings us to the question as to where we are heading these days in scientific, and "physical" (if one pleases) research. When one says "psychical" to some folk, they become either frightened, pulling into their shells, or else they become almost indecently eager. So why not say "physical" instead—apparently there isn't such a great gap between the two terms anyway!

The Great War and its aftermath have stirred up the most wonderful and the most powerful of the pent-up mental energies of the world. Much of what is to-day termed "mental unrest" in our sphere of existence is no doubt nothing more or less than conscious and subconscious groping on the part of humans for truth.

The millions of the rank and file, who for their various countries, went into the war, fired with patriotic ideals, full of noble impulses for service and determined to wipe out calculated warfare, have returned to their

various nations a good deal disillusioned on many things. All their previous conceptions of things are upset. "What is the *truth* about life?" they exclaim. Maybe they do not exclaim aloud, but the great query is there. They are troubled about the future of our earth. As one sympathetic woman writer, Elizabeth Frazer, has expressed it, they are suffering from "world shell shock."

That is probably the compelling reason why such enormous interest is being evinced everywhere in the views of scientists in whose intellectual honesty the world has faith.

England, deeply affected and wrung by the Great War, has been a sort of mental battle ground for scientific thought, debate and truth-seeking. The Royal Astronomical Society (London) has been a Hastings for fighting out the Einstein theory, with the invader from Europe winning his way!

Great heed has been paid to the words of such thinkers as Sir Oliver Lodge of England, and in economically more virile America, where he quickly found a welcome, he seems to have been pointing the way to the very results it may be hoped will come of his own predictions.

Based on the results of wars for the last 800 years, which have been tabulated by a mission of international bankers, and the lessons of whose researches the writer has had the privilege of analyzing, it will take the various nations engaged in the conflict from eighteen months to fifteen years to recover physically from its effects. The mental, spiritual and scientific results of the war, however, many thinkers agree, will not have begun to bear fullest fruition for a generation, even under the stimulus of the present great "urge."

Astronomy is making vast seven-league strides and is on its way to much bigger things in the way of discoveries telling us of the "measurable" parts of the universe about us. Even present-day discoveries are reversing the evidence of the senses, and as Sir Oliver says, one need not dogmatize in hailing these discoveries. As he has observed, we are able to study the heavens, and Earth's relation to them, and to make some beginnings at the comprehension of the vastness of the universe, because our planet is surrounded by a clear atmosphere! Were we cut off from the rest of the solar system by a foggy or cloudy atmosphere, such as surrounds Venus, our view would be "miserably constricted," a further proof of the fallacy of depending solely on the senses for information.

"Remember," warns Sir Oliver, "what our senses are and how they arise! They arise in the process of evolution to enable us to get our food and to escape our enemies. They rise from low down in the scale."

Our kindly British thinker believes even that our senses were not given for the purposes of philosophy, and that they are strained unduly when so used. Faulty reasoning and faulty deductions have followed philosophical strains—is it not a byword that one can prove anything by philosophy, even to the point that we don't exist!—so it is natural that progress up to the present has been slow.

It is entirely possible that Nature has deliberately set the Lodge "veil" about us so that the magnitude of the universe will not keep us from our daily tasks and the business of our lives. Still we must keep open minds, susceptible to new truths as they develop through the discoveries of the more advanced mentalities, and as we develop from decade to decade in education, our commonplace intelligences will be able to absorb and digest more and more of what is beyond in science. * * * "It has become the humble property of men of sciences to begin to establish this in an ordinary workday manner. Sciences, the sciences of the future, will have a message to humanity whereby the results which have been attained by the few can be made accessible to the many. The peak whence these things are visible has been reached by people who don't need to climb, who can ascend by balloons or some other method, by intuition and inspiration. We workers in science must construct the staircase, the road by which we slowly grope our way."

So, if the first definite result of the visit of Sir Oliver Lodge to the United States goes no further, it has left his sound messages on behalf of constructive thought and conception bearing on the vital things of science. He believes leaders in discovery in anatomy and physiology, though commonly "materialists," are to be trusted in their positive statements. When they deny, however, the existence of what they and their instruments cannot perceive they are merely denying what may only be invisible to them, and so they are proving nothing, or disproving nothing, as one likes to put it. A child, blind from birth, may deny the colors of the sunset.

We are taught the fine constructive principle of positivism or affirmation, (not dogmatism, however) as opposed to negation. "As a general rule, positive statements we may hold as at least worth hearing, but a negative statement, denying something, is probably not worth hearing." In other words uncertainties, or lack of knowledge, do not prove the opposite of a logical conception. They are merely zeros.

In the thought lies an access of future hope for the inventor, the engineer, the chemist and the machinery constructor, all of whom know of past experience that the "impossible" has frequently been attained, and that what at first blush appeared "intangible" and "unsubstantial," has later proved quite the reverse.

LIGHTING AND VENTILATION

The Minister of Health (England) has refused a proposal to raise the minimum height of living rooms in new houses from 8 ft. to 8 ft. 6 in. "An extra 6 in." it is said, "entails an extra cost of nearly £7 in quite a small brick cottage, and with this £7 it would be possible to install electric light. The gas interests find 8 ft. too low for their purposes; they cannot install pendents unless they are situated over a table, otherwise people would knock their heads and shatter mantles. On the other hand, an electric fitting can be fixed to the ceiling, and its lowest point be 7 ft. high, clear out of reach of the normal human being, hat and all. A lot of nonsense is talked about cubic space and ventilation. An extra 6 ins. in height gives additional space, of course, but it does not improve the atmosphere. Ventilation comes in from door and window chiefly, and for a given ingress of air the smaller cubic space is the more frequently renewed. What our gas friends are after is not hygiene or elbow room but head space for their gaseliers."

GASSING THE ORANGE GROVES

Gas warfare is still active in the service of man, but no longer against human enemies. One of its activities is directed against destructive pests in the orange groves of California. Every year Southern California orange growers spend $2,000,000 in gassing scale pests on citrus trees and in fumigating orange groves.

The illustration here reproduced from *The Gas Age* seems to require no explanation. The gassers cover the trees with chemically treated cloth tents and then spray the branches with hydrocyanic gas, a combination of sulphuric acid and cyanide. This is delivered to the orchards in liquid form. The gas is a deadly poison and each year there are several casual-

Gang of gassers at work

ties among the men employed to do the work. An acre of trees can be gassed in an hour by a crew of four men.

As a supplement to the above, and of additional pneumatic interest, we have the following note from another source.

A novel use for balloons has been developed in California, where one is being used for hoisting tent-like covers over citrus trees which have to be fumigated. The balloon has a capacity of 3000 cubic feet and takes the place of a high travelling derrick, which was liable to damage the trees while being moved about the orchards. The balloon and a crew of four men place between 25 and 30 tents an hour over large Valencia trees. The derrick outfit with seven men places but fourteen or fifteen tents an hour.

A new floating 30,000-ton drydock, the largest of its kind in the world, has been put into commission by the Morse Dry Dock & Repair Company of South Brooklyn, New York. The company is also opening a heavy marine forge shop which will be capable of handling fluid, compressed steel and alloy forgings up to 75,000 pounds. The Morse organization, which has grown greatly in personnel, buildings and facilities in the last five years, is now handling all kinds of big ship repair work, including reconditioning and conversions of ocean-going vessels.

Concrete Barge Built by Cement Gun

Fig. 1 shows longitudinal and cross stringers and method of blocking. The cement gun is on the right. Fig. 2 shows method of applying the concrete to the walls dividing the compartments.

THE ACCOMPANYING photos show the first concrete barge on the Pacific Coast to be built by the cement gun process. Figure 1 shows the cement gun on the extreme right, having been placed alongside of the barge, and figure 2 shows the method of applying the concrete to the walls dividing the compartments. There are twelve compartments, the walls of which are approximately four inches thick. Hatches through the upper deck lead to three compartments only, this precaution being taken so that in case of being stove in the water will not reach the remaining compartments.

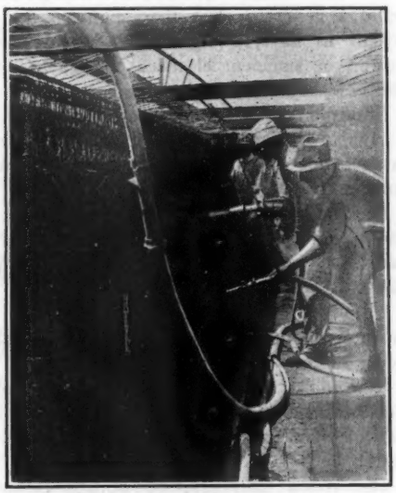
The barge is used as a landing place and is subjected to very rough treatment. The barge will carry a live load of 50 tons. It has a dead weight of 350,000 pounds; is 100 feet long, 20 feet in width and six feet in depth. It was built at the municipal repair yards of the Los Angeles Harbor Commission.

The walls, floor and bulkheads are reinforced with wire fabric ¾-inch square. Twisted bars were placed at the top and bottom to take care of the stress when riding the waves on launching. There was considerable steel reinforcing material that remained after the construction of Municipal Pier No. 1, and this was used in the construction of the barge. It was built on the ways of the repair shops. The city forces assembled the reinforcing, furnished the forms and put the same in place. A private contractor applied the concrete, about 100 yards of which was used. Material was used just as it came from the sand bank, as it contained the right proportion of sand and gravel. All the material would pass a ¼-inch screen. Six men were employed by the city for a period of about 30 days in the construction of the barge.

The upper deck was heavily reinforced, being four inches thick. During construction the forms were supported on four longitudinal stringers 12 inches square, and the longitudinal stringers were on cross stringers, 12 inches square. All this was carried on blocking above the ways. Blocking was placed along the edge of the barge sufficiently far from the

ways to clear the pony trucks, when they were to be wheeled under the barge for launching.

Figure 1 shows the longitudinal and cross stringers and method of blocking them up above the ways. This illustration also shows the pony trucks to the left and the track on which they run. The stringers were also blocked up by two rows of blocks in the center. Three weeks' time was given the concrete to set. When ready to launch the blockings



Applying the concrete

were removed from under the center stringers, and the pony trucks run under the barge which was then lowered onto the trucks by jacks. The pony trucks were connected to an electrically operated drum by means of a steel cable, the motor being geared six to one. The barge resting on the pony trucks was lowered down the ten per cent grade by the motor and the timbers and pony trucks were weighted down with steel rails sufficiently to permit the barge to float off. The wooden forms were then removed.

AIR CONSUMPTION OF COAL CUTTING MACHINES

By S. BARBER

TESTS FOR AIR consumption have been taken recently on four different types of coal-cutting machines. Two of the machines were driven by so-called air turbines and two by reciprocating engines; all were of the chain-cutter type, with one exception, which was a bar machine. All the machines were cutting in coal on a face approximately three-fourths face on and one-fourth end on. The results of the tests cannot be claimed to be truly comparable, as the machines were not all tested over the same ground. It is, of course, impossible to do this. They were, however, all tested in the same seam.

The instrument used for measuring the consumption of air was a "Sentinel" meter valve made by Messrs. Alley & MacLellan, Limited, of Glasgow, who claim it to be correct to two and one-half per cent. It merely consists of an ordinary three-inch slide valve, bored and turned to limit gauges, so that the area past the valve with a definite opening is the same for all valves of the same size. Attached to the valve is a scale accurately divided into millimetres for indicating the amount of opening of the valve, and it is adjusted so that when the valve is just opening the pointer is at zero. Attached to the valve is a manometer, an air-pressure gauge, and a thermometer.

Tests of Air Consumption by Coal-Cutting Machines.

Date of test, 1919.	Type of machine.	Average air pressure when cutting.	Yards cut.	Time.	Depth of cut.	Square yards cut.	Free air used per min.	Free air used per sq. yd. cut.
		Lbs. per sq. in.		M. S.	Ft. in.		Cub. ft.	Cub. ft.
June 24	A (1)	49	10	17 10	4 8	15.5	645	714
July 2	A* (2)	41	10	18 50	4 9	15.8	475	566
June 26	B† (1)	43	10	83 35	5 3	17.5	450	2,149
July 1	B‡ (2)	49	10	25 0	5 9	19.2	600	780
November 13 ...	B§ (3)	47	10	48 10	5 6	18.3	630	1,589
November 14 ...	B‖ (4)	53	10	38 55	6 0	20 0	725	1,410
June 27	C** (1)	41	10	44 45	4 0	13.3	475	1,590
July 3	C†† (2)	46	10	38 0	4 1	13.6	500	1,397
September 19 ...	D‡‡ (1)	47	10	66 30	5 0	16.6	920	3,679
November 15 ...	D§§ (2)	43	10	50 40	5 3	17.4	830	2,417

* Same machine: turbine driven. † Turbine-driven: too much clearance between rotors and casing. ‡ Turbine-driven: different machine. § Turbine-driven: different machine and fitted with new type of step-tooth rotors. ‖ Turbine-driven: same machine as in Nov. 13 test. ** Reciprocating engine: three 8-in. cylinders. †† Reciprocating engine: three 8-in. cylinders. ‡‡ Reciprocating engine: four 6-in. cylinders. §§ Reciprocating engine: four 7½-in. cylinders

The method adopted for testing was to run each machine over a measured distance of ten yards without stopping the engine. The pressure, temperature, and openings of the valve were taken for each yard cut, and then averaged. The air was compressed on the surface to 60 lbs. per sq. in., and used on the machines approximately a mile from the pit-bottom.

In the table (appended) showing details of the tests, it will be noted that both the air consumption per minute and that per square yard are shown. The former figure is of little value, and it is the latter figure which gives much useful information. In the writer's opinion the air consumption per minute appears to be of no consequence so long as the machine is getting over the ground and doing some work. The very marked difference in the figures showing the air consumption per square yard cut will possibly raise some doubt as to the accuracy of the tests. The author can only say that the tests were taken as carefully as possible. In one instance, namely, Test 1 of type B, the reason for the high consumption is known. The rotors in the machine had worn, and there was too much clearance between the rotors and the casing, thereby allowing a large amount of air to blow through without being really effective.

It may be of interest to note that Type A machine was new in April of 1919, and the machines in Tests 1 and 2 of Type B were older machines. The machine used in Tests 3 and 4 of Type B was an old one with a new set of stepped-tooth rotors, the tests being taken within a week of the machine going down the pit. The air consumption per square yard is not to the advantage of the new type of rotor when compared with the old type used in Test 2 of Type B. Again, it might be pointed out that Tests 1 and 2, Type C, were made on a practically new machine fitted with what the makers claim to be a new type of engine. The machines used in the tests Type D were both some years old, but have been practically rebuilt several times. It will be noticed that Type A came out with the best results, followed fairly closely by an older machine of Type B.

As matter of additional interest, it may be mentioned that a representative of the makers of Type A gave the author the figure of 850 cu. ft. of free air used per square yard cut as being the consumption of their machine in a test against another machine of a different type to those tested by the author, the consumption of the latter coming out at 1,800 cu. ft. of free air per square yard cut.

[NOTE—The above comprises a paper read before the North Staffordshire Branch of The National Association of Colliery Managers. It, of course, represents English practice exclusively. The great difference in the last column in the rates of air consumption is quite remarkable.—THE EDITORS.]

GASES IN COAL MINES

According to *Coal Age*, the principal gases found in coal mines are the following: Methane or marsh gas, sometimes called light carbureted hydrogen (CH_4); carbon monoxide (CO); which is the "whitedamp" of miners, carbon dioxide (CO_2), which, mixed with nitrogen, forms the chief ingredients of the blackdamp of miners. In addition to these principal gases, occur, in limited quantities, hydrogen sulphide or sulphurated hydrogen (H_2S), the stinkdamp of miners and the heavy hydrocarbon gases that are associated to a limited extent with methane; namely, ethene or ethylene (C_2H_4) belonging to the olefine group; and ethane (C_2H_6), belonging to the paraffin group. Of the gases named, methane, olefiant gas, carbon monoxide and hydrogen sulphide form explosive mixtures with air in certain proportions. Carbon dioxide and the nitrogen of the air are the only ones that are not explosive.

Some examples of trees used as conduits for the water supply of London prior to the advent of cast iron pipes were discovered during some excavations in a street off Shaftesbury-avenue, London. Several fir tree trunks, about twenty feet in length, were unearthed, with the centre bored through at a diameter of eight to ten inches. They are in a fine state of preservation, although it is estimated that they have lain underground for at least 200 years.

Extracting Electrical Energy from the Atmosphere

By HAVELOCK C. HISLOP

IT HAS LONG been the pronouncement of science that the outer air, or at least the ether beyond the earth's air belt, contains unguessed and untold power which may some day be harnessed for the free use of mankind. There now comes an announcement to COMPRESSED AIR MAGAZINE from Seattle, Wash., that Albert M. Hubbard, a youth not yet twenty, who has dabbled in science, and electrical experimentation particularly, has probably "tapped the inexhaustible reservoirs of nature's energy and harnessed to the use of man the illimitable power that permeates the universe." We have heard similar stories before, of course, about the snatching of power from the air, and nothing has come of them. Who has forgotten the commission from Washington that visited Worcester in the course of the war? One cannot help but remember Garabed Ghiragossian. But this report, somehow, has a different ring to it.

As a youth Hubbard would seem to be ingenuous as well as ingenious, and there may be hope in that circumstance for the system he is declared to have evolved. Hubbard has announced the completion of an invention which he terms an "atmospheric power generator." He has also made a demonstration of it that is stated to have made Seattle's leading electrical engineers doubt the evidence of their senses. They at all events hesitated to condemn as folly the assertions of the youth as to what his apparatus would accomplish.

This publication cannot be sponsor for the accuracy of the report from Seattle, which, if true, is likely to overturn the power field, but on the other hand the statements contained in it should be made public so they may be investigated scientifically. Pacific Coast engineers declare that if the apparatus is proved to have the merits its inventor claims for it, the world of power and motion will be revolutionized. It would mean the discarding of steam and gas engines, of ponderous and complicated electrical generating devices, and of steam and water turbine generators. All the mechanism of transmission wires and transformers would become obsolete. Electrical transportation would enter a new era; air transportation would be advanced hundreds of years. Submarine practice would be changed. Most important of all, cheap power would be instantly available to all mankind.

The Hubbard apparatus in appearance is described as a small coil of wire about six inches in diameter, surrounding a permanently magnetic core eight inches long, the entire contrivance being easily carried by a man in his hands. With this outfit Hubbard gave a demonstration several miles from his laboratory that, regardless of the principles involved, several Seattle engineers declared without parallel in electrical history.

An ordinary incandescent electric light connected with the two terminals of the "atmospheric power generator" glowed to a cherry red for nearly an hour, and Hubbard volunteered to permit the lamp to burn for as many hours as was necessary to satisfy the most skeptical.

The young inventor says there are no moving parts connected with his generator, that there are no hidden batteries, storage or primary, and those who witnessed the demonstration made sure that there was no outside connection with any source of power.

Hubbard's explanation of the phenomenon is that he has succeeded in transforming the earth lines of magnetic force into electrical energy available for use.

While electrical engineers were highly skeptical and held to the possibility of fraud, nevertheless George Quinan, superintendent of electrical operations of the Puget Sound Traction, Light & Power Co., said, "whatever the lad has done it is a marvelous demonstration."

All the experts agreed that if as Hubbard declares, there are no moving parts and no concealed battery, the invention is revolutionary. They had no explanation to offer for its operation.

Young Mr. Hubbard declared he could obtain four kilowatts, equivalent to more than five horse-power, from a contrivance weighing less than twelve pounds, and that he could build a generator less than eighteen feet in length to develop eighteen thousand horsepower, or sufficient electrical energy to drive the new battleship *New Mexico*.

Someone should surely give him the chance!

Hubbard offers to build for $50 a generator large enough to drive a motor car, but much smaller than the present engines.

One hastens to commend this statement to the attention of Mr. Henry Ford; maybe he can evolve now the hundred-dollar automobile!

The Hubbard generator, according to its inventor, would give the airplane unlimited flying range.

It would, if it is a fact, and it would solve world transportation problems and cut the high cost of living and loving to negligible quotations!

The young man says he worked eighteen hours a day for two years before he arrived in Seattle and during the year since perfecting the apparatus. His first model was built a year and a half ago, he said.

Hubbard asserts that his four kilowatt machine has continuously excited the equivalent of 120 ordinary 25-watt house lamps to full brilliancy for three months. The device during this time, he says he is ready to take oath, did not receive outward stimulus and, at the time the test was completed the lights were burning at the same brilliancy.

This Hubbard system would be of peculiar interest to users of compressed air. If power can be snatched from the air to compress air, there is no telling the extent to which compressed air may be put!

Mr. Hubbard and his apparatus should be thoroughly investigated.

AIRPLANES AND BEE FARMING

The following story from the *Scientific American* suggests the wide adaptability of the airplane, especially in industrial emergencies, and the rapidity with which its services are being availed of.

In the stress of a seed-time or harvest emergency, farmers have had to pay unprecedented prices for labor, but none, so far as it is known, has equalled Nelson W. Peck, of the Yakima Valley, Washington. Peck keeps bees—a lot of them. Fruit blossoms are an important source of nectar out in that country, and spray-poisoned orchards a lively menace to the bee-keeper. In fact, in 1918, Peck lost over 700 hives of bees from poisoning, a mighty big loss when we consider the depreciation in his investment together with the loss of potential profits. Honey prices were a way up, so that every single efficient colony was a sizeable asset.

To prevent a repetition of poisoning losses in 1919, Mr. Peck employed expert labor at $1 a minute—$60 an hour. The expert was an aviator. Is Nelson W. Peck the first farmer in the United States to employ an aviator in his farming business?

On the first of several flights with the aviator, Peck was up 75 minutes. His object was to pick out stands for his bees sufficiently removed from spray-poisoned orchards to guarantee safety, and he could think of no way of doing this like observation from an airplane. To Peck, the cost of the service, $1 a minute, was a mere trifle, beside its value to him. He says he would have saved $10,000 in 1918 had he taken such a flight before setting his bees. The system followed by big beekeepers like Peck is to establish small yards at scattered points in a wide territory, as in this way only is it possible to keep many hundreds of colonies. As the honey bee seldom forages more than two miles from the hive, it is practical to make locations from an airplane.

F. A. Wilde, who died recently in Oshkosh, Wis., aged 76, had been a pioneer silver miner at Ouray, Col. In 1890 he became identified with the Nordberg Manufacturing Co. of Milwaukee. A year later he moved to Kingman, Ariz., to install the plant of the Desert Power & Water Co., which now supplies electric energy to the larger camps of Mohave County. He became the principal stockholder of the enterprise and had been its president since its organization.

Dynamite Used to Extinguish Gas Well Fire

By A. H. CLOUGH*

WHAT IS conceded to be the largest gas blaze ever encountered in the oil producing industry occurred at one of the Standard Oil Company's wells near Taft, California, about midnight July 26th, 1919. With a flow of 180,000,000 cubic feet of gas every 24 hours, shooting upward under enormous pressure, the well blazed for ten consecutive days and nights. All known methods of extinguishing it were tried and proved of no avail, until the plan of putting it out with explosives was submitted and tried.

The Standard Oil Company was drilling with a rotary drill in well No. 7, in the Elk Hills, near Taft, in the Midway Oil Fields, California. The well was at a depth of 2,135 feet in ten-inch casing, when a supposed water sand was encountered. To test this sand for water, the mud in the well was bailed down to relieve pressure, and to allow any water present to accumulate in the well. During the course of bailing, at 11 P. M., July 26th, the well blew out under tremendous pressure and the greatest flow of gas in history began.

Casing Becomes Red Hot

The drilling crew attempted to get the well under control by closing the 12½-inch gate valve with which the casing was equipped but the shale and sand carried by the stream of gas cut out the seat of the valve while the gate was being closed, and the well continued to blow. Two hours after the flow began, the friction caused by shale and sand traveling at a great velocity had produced a red-hot heat on the casing, and the gas, igniting, burst into a column of fire, gushing 300 feet skyward. Its maximum width of about 50 feet was reached after the flame traveled about 100 feet upward. The gas emerged from the casing with such force that for a distance of twelve feet above the casing there was no flame.

The derrick, 100 feet in height, was immediately consumed, and all that remained was a twisted mass of iron and steel and machinery.

Metal at the casing melted, while within a radius of 50 feet it was reduced to a white heat. Everything within hundreds of feet was burned and baked.

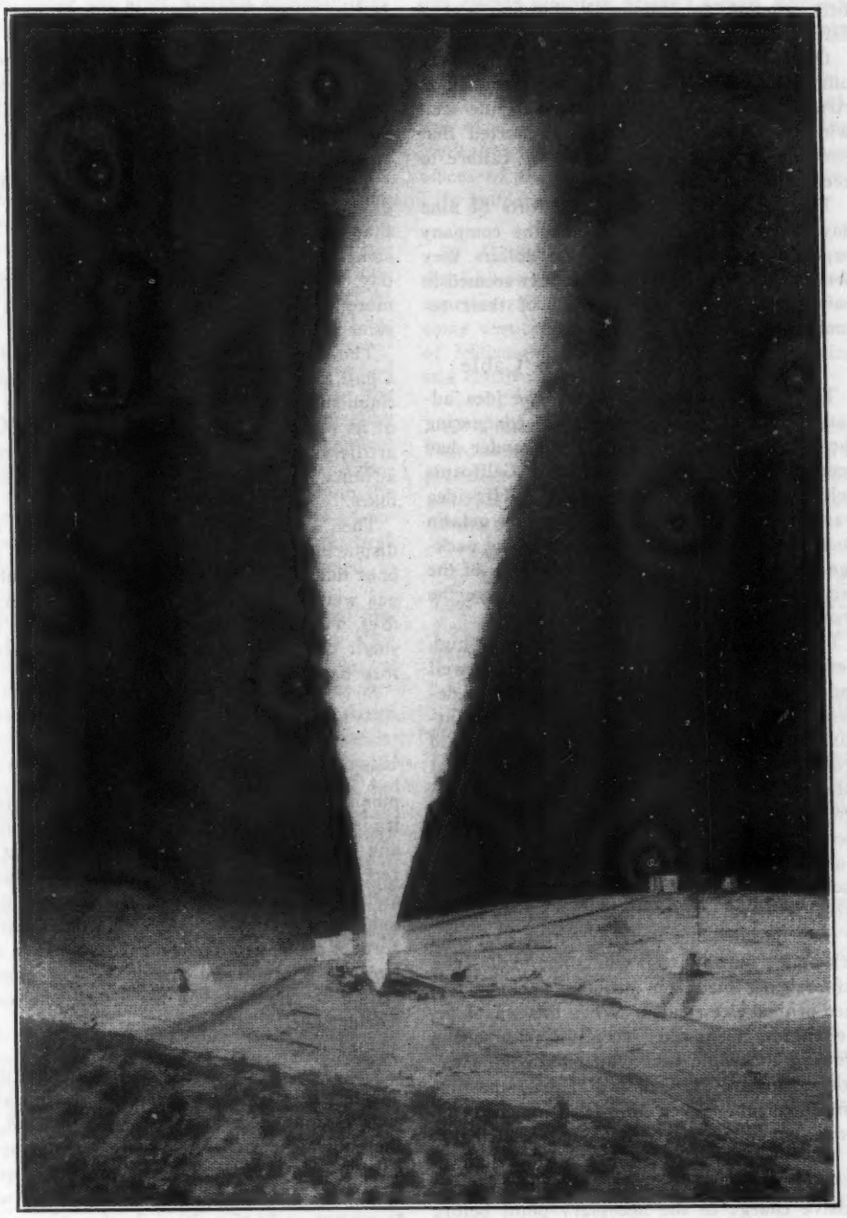
A thermometer, registering 300 degrees F., broke at a distance of 250 feet from the fire.

It is reported that the fire could be seen from a distance of 80 miles, while the roar from the escaping gas could be heard at a distance of ten miles.

Men could not hear each other shouting within a radius of 1,000 feet of the well, and deafness resulted among the fire fighters. All plans were carried out by signals.

Steam and Water From Ten Boilers

The first attempt to extinguish the fire was made July 27th, by the assembling of ten boilers. From both the blowoffs and the steam connections of these boilers three-inch lines were laid to within 50 feet of the well where each branched into two two-inch lines and ran to the base of the flame. With the base of the flame twelve feet above the ground level, the work of laying these pipe lines, nevertheless, became a matter of human endurance against heat. The men worked behind large portable metal screens, with a stream of water constantly playing upon them from a three-inch fire hose. Water lines were also laid, and with the boilers and pumps throwing steam and water into the flame to their full capacity there was no noticeable effect upon the fire.



Burning gas well that was extinguished by a dynamite explosion

Shortly after all the casing above ground blew off, and the well began to crater, allowing the flame to draw down to the ground level.

The second attempt was made with the full capacity of sixteen boilers and four pumps throwing steam and water through three-inch and four-inch lines, but this effort showed no more results than the first.

Boilers, Pumps and Tanks Failed

The third attempt was made with twenty boilers throwing steam and water, four rotary pumps throwing water, two 125 barrel tanks with four-inch steam jetted lines, and two pumps throwing fire foam.

*Technical Expert, Giant Powder Co., San Francisco, Cal.

With the preparation for the fourth attempt completed, there were 21 three-inch lines and nine four-inch lines into the fire crater. Twenty boilers and eleven rotary pumps ready to throw steam, water, mud and carbon tetrachloride. This attempt along with the fifth attempt to extinguish the fire was a failure.

Officials of the company brought artillery officers from the Western Department, U. S. Army, who considered bombarding the well with field howitzers, but who reported that portable artillery was too small in calibre to accomplish the task.

Thus through the fatiguing efforts of nine days and nights, in which time the company expended nearly a half million dollars they arrived at the point where all effort seemed in vain, and had reached the end of their resources.

Explosive Suspended on Cable

The company now considered the idea advanced by Mr. Ford Alexander of conquering the fire by explosives. Mr. Alexander had been engaged in oil-well blasting in California fields for the Giant Powder Co.. His idea was to suspend a package of blasting gelatin upon cables, in such a manner that the package could be safely brought to the edge of the fire at a distance of about 40 feet above the ground.

Two derricks approximately 40 feet high were built on either side of the burning well and so far away that the heat would not destroy them. A 9/16-inch steel cable was attached to the top of one of them, then laid around the well outside of the terrific heat zone, to the other derrick where it was run through a pulley at the top and the end attached to the drum of a small winding engine underneath. The explosives, bound in one package and covered with heavy sheetings of asbestos, were securely attached to this cable at the same distance away from the first derrick as the burning well was. The explosives, before being made up into this package had been primed electrically. When this was done, the engine under the second derrick began drawing the cable taut which pulled the explosives toward the well and at the same time hoisted them. When they had reached the proper spot, they were exploded electrically. It is unnecessary to state that this had to be done very quickly so as to bring the explosive charge to the necessary point before they were ignited or exploded by the heat from the burning well.

With a stream of water from a three-inch hose playing upon him, and upon the protecting screen behind which he was working and upon the ground over which he was advancing, Mr. Alexander worked forward with the explosive package for the purpose of being sure that the package was in the position he wanted it at the moment of explosion.

Explosion Extinguishes Flames

As the package drew near the column of gushing fire the suction of rushing air drew it to the flame, and as it reached the outer edge of the fire Mr. Alexander exploded the package. At the moment he exploded it he was within 200 feet of the explosion but states that he neither heard nor felt anything.

Eye witnesses at a greater distance state that when the package exploded, the gas well fire was divided into three sections. The section at the point of explosion was moved bodily away from the column of gas in a horizontal direction, the upper section was blown upward and beyond danger of re-ignition of the gas column, while the lower section was snuffed out very much as a candle is snuffed out, the flow of gas being temporarily checked.

To get an idea of the enormous amount of gas flowing from this well one has but to note that the entire city of San Francisco consumes but 22,000,000 cubic feet of gas each day, and that this well alone would supply more than enough gas for eight cities the same size.

The Standard Oil Company expended nearly a half a million dollars in vain attempts to extinguish the fire, and had arrived at the end of its resources in gas well fire fighting. Army artillery officers were called upon but could advance no plan to snuff out this colossal blaze.

Then explosives come to the aid of men displacing old ideas and methods with new ones that are more economical. In the future, gas well fires, oil well fires, and oil reservoir fires, will be extinguished with explosives at a small comparative cost to what has heretofore been expended.

Notes of Industry

The American Economic Association has published a report of its committee on foreign trade, which deals with the present outlook and which goes deeply into conditions that affect the present status of foreign commerce and its future development. The report deals exhaustively with the influence of the war on foreign trade, new trade currents and the outlook for international commerce, with especial regard to the place of the United States in world trade.

The New Jersey Zinc Company, for the third quarter of 1919, reported a surplus, after charges and Federal taxes, of $2,610,918, or the equivalent of $7.45 a share on the capital stock of $35,000,000. In the preceding quarter the earnings applicable to dividends were $1,491,337, or $4.26 a share. In the corresponding quarter of 1918 the earnings amounted to $9.83 a share.

At a meeting of the Board of the Belfast (Ireland) Harbor Commissioners, the Chairman stated that, as oil would probably be the most important development of the time in regard to power, preparations had been made for the establishment of a great oil depot in Belfast, with wharfage facilities to accommodate oil tankers ranging up to 20,000 tons. The depot will be near the Belfast Corporation's new electric station, giving the municipality an opportunity of using with equal economy either coal or oil. In the course of his remarks the Chairman referred to Lord Fisher's statement that the future of the British merchant marine lay in internal combustion engines.

The Olympic liner of the White Star Line and the big Cunarder, Aquitania, are both being converted for oil burning. It is expected that greater efficiency, and greater speed will be obtained with reduced fuel cost, and that the boiler room personnel of each ship will be reduced from 350 to 40 or 50.

There will shortly be under the American flag 1,731 oil-burning steamers, nearly 10,000,000 deadweight tons. Fuel stations are being established so that these ships may make a world circuit without fueling at other than American-owned stations.

The Busch-Sulzer Bros. Diesel Engine Co., St. Louis, Mo., announces the opening of its Eastern sales office, 60 Broadway, New York. George D. Pogue is Eastern sales manager, and Stanley Wright, assistant Eastern sales manager.

The iron and steel plant of Monterey Iron & Steel Co., Monterey, Mexico, will be enlarged as soon as conditions in Mexico become more settled. This plant was constructed many years ago at a cost of $10,000,000 gold. It is owned principally by Italian interests. Its several departments are now running almost to full capacity.

Construction is soon to begin on the new Liberty tunnel through the south hills at Pittsburgh, the contract having been awarded to Booth & Flynn, Ltd., Pittsburgh.

Last year 44,000 cu. yd. of sand was purchased for the South Boston Strandway for $26,400. It was brought from the South Shore and spread along the bathing beaches. Today it is difficult to find the slightest trace of that sand, except perhaps in the houses of the neighborhood, the manufacturing plants, the sewers and the hedges. The sand was blown away by the ton and a similar layer to replace it would now cost $110,000.

Spain, in common with most European countries, has a coal problem, but its situation is diametrically opposite to that of its neighbors; that is, it has a supply greater than the demand. Piled up at the heads and in the coal ports of Asturias lies a stock estimated at from 750,000 to 1,000,000 metric tons (metric ton equal 2,204.6 pounds), and the problem of the moment is how to dispose of this surplus.

Coal production in the country for 1919 has been placed at 544,263,000 tons compared with 678,212,000 in 1918. This excess of nearly 134,000,000 tons mined in 1918 over the year just closed is accounted for in large measure by the fact that 1918 production was speeded up under the stimulus of war needs, which made that year epochal in the history of the fuel industry of the country. The United States alone of the allied countries was enabled to exceed its pre-war rate of produc-

tion in 1918, which was 120.2% of that of 1913, despite the fact that more than 125,000 men were temporarily lost to bituminous production in 1917 and 1918 and had to be replaced by others. Great Britain's output in 1918 was 255,345,440 tons, or only 79.3% of 1913 production.

W. R. Grace & Co. announced that fortnightly passenger service from New York to the west coast of South America, with Valparaiso, Chile, the southernmost port of call, will be possible when two more ships are put on the route early in the Spring. Before the United States entered the war the company had ordered five new steamers for this service. All but one were taken over by the government for transport service. Two of these vessels are now making the run between New York and the west coast of South America and two others will be ready for service in March. All steamers to the west coast of South America are now booked for months in advance, and it is believed that these additional ships will relieve the situation.

The reinforced concrete chimney, 570 feet high and 26 feet three inches inside diameter at the top, built at Saganoseki, Japan, was the subject of many investigations by Professor Omori as to the movement of the top when subject to wind pressure. Wind velocities were recorded ranging from less than one mile per hour to a hurricane velocity of 78 miles. The amplitude of vibration at a velocity of 50 miles per hour was less than one inch., while at 78 miles per hour it was 7.32 inches. The maximum amplitude was in a direction at right angles to that of the wind. Professor Omori thinks that with the wind gusts of 110 miles an hour which they occasionally have in Japan the amplitude would be at least 15 inches. The period of vibration was nearly constant for all velocities, varying only from 2.52 to 2.56 seconds.

A proposal dealing with the installation of water and drainage canals in fifteen capitals of departments in Uruguay, practically all the towns in the country, has been made by the Ulen Contracting Corporation, which has already carried out successful water and drainage contracts in the leading Uruguayan cities of Salto, Paysandu and Mercedes. The project was to be presented to the national authories by the Minister of Public Works. Two-thirds of the work would be undertaken for account of the Ulen Company, and a third would be apportioned among various local contracting interests. The cost of this undertaking would run into some $18,000,000 gold, and it is said that the New York capitalists who are behind the Ulen Corporation will have no difficulty in regard to the financial arrangements found necessary.

It is announced that the plan of the International Motor Truck Corporation to take over the New Brunswick (N. J.) plant and other assets of the Wright-Martin Aircraft Corporation, amounting in value to approximately $8,000,000, has been consummated.

CONVENTION OF COMPRESSED GAS MANUFACTURERS

The seventh annual meeting of the Compressed Gas Manufacturers' Association was held at Rumford Hall, Chemists Club, New York, in January. The President, Dr. Hugo Lieber, made the brief opening address. Reports of the officers were read, as well as reports of the auditing, finance, membership and test and specification committees. A spirited discussion followed the report of the test and specification committee.

Col. B. W. Dunn, Chief Inspector of the Bureau of Explosives. addressed the meeting and talked regarding the work done during the last year concerning cylinder specifications. He spoke of the help given the Bureau by the association, the value of such help and the unselfishness of the members in such work. At the afternoon session the reports of the Legislation, the Business Methods and the Transportation Committee, were read and discussed and Col. E. J. W. Ragsdale, formerly of the Ordnance Department, addressed the meeting with an interesting talk on the development of the Chemical Warfare Service. Prof. Comfort A. Adams talked to the members on the subject of coördination and the results of coördination, particularly as applied to research work. Five new members were elected to membership.

The association held its seventh annual dinner at the Manhattan Club, New York City. Covers were laid for 230 representatives of the different companies. The attendance surpassed by 90 the previous record of attendance. The Compressed Gas Manufacturers' Association now has on its roll 155 members; consisting of 99 compressed gas manufacturers and 56 individuals or concerns directly connected with the compressed gas industries. Approximately 98% of the compressed gas business of the United States and Canada is now represented by the Association.

Personal Intelligence

A. W. Swan of the sales department of the Canadian Ingersoll-Rand Co., Sherbrooke, Que., with headquarters in that city has been appointed secretary of the Engineering Institute of Canada with offices at Montreal, Quebec.

* * *

E. R. Jones, the one-time celebrated "Pike" Jones of the Michigan College of Mines, who was until recently Chief Engineer of the Victoria Copper Mining Company of Victoria, Michigan, has resigned to take a new position in West Virginia as Superintendent of the Raleigh-Wyoming Coal Company at McGraws.

* * *

Edward Brush, Vice President of the American Smelting and Refining Co., and for more than 40 years actively engaged in the metal business, died in January at his home in Greenwich, Conn. Born in Greenwich in 1854, he was graduated in 1874 from the Sheffield Scientific School of Yale University. He was Secretary of the Consolidated Kansas City Smelting and Refining Co. from 1888 until 1898, when he served in the same capacity and later as vice president of the American Smelting and Refining Co.

* * *

Hale Holden, Director of the Central Western Region of the Railroad Administration, was elected president of the Chicago, Burlington & Quincy and the Colorado & Southern Railroads.

* * *

R. H. Brown, Jr., of the St. Louis, Mo., office of the Ingersoll-Rand Company, New York, has been appointed manager of the new offices of the company in the Sam Houston Life building at Dallas, Tex.

* * *

W. H. Scales, chief designing engineer of the Lackawanna Bridge Company, with headquarters at Buffalo, N. Y., has resigned to become associated with W. E. Russ, architect, of Indianapolis, Ind., as chief of engineering and construction.

* * *

At a meeting of the directors of the Simms Petroleum Co., Thomas W. Streeter, vice-president of the American International Corporation was elected a director and a member of the executive committee.

* * *

J. M. Francis, for years manager of the Tom Reed mines and mill at Oatman, Ariz., died recently in a Los Angeles hospital. Interment was at Kingman, Ariz.

* * *

Carl B. Anderson, formerly with the Illinois Geological Survey and the Gulf Oil Corporation, has joined the staff of Rogers, Mayer & Ball, of New York and Boston, who announce that their facilities for the examination and appraisal of oil properties will be extended.

* * *

Frank E. Lathe, formerly with the Anaconda and Chile Copper companies, is chief chemist of the British-America Nickel Corporation at Sudbury, Ontario.

* * *

R. J. Windrow, state highway engineer of Texas, is, since Jan. 1, the highest paid state officer, his salary as granted by the State Highway commission, having been increased to $10,000 a year.

* * *

Charles F. Willis became editor and special field representative of the *Arizona Mining Journal* with headquarters at Phoenix, Arizona, on January 1st, according to the announcement of the publisher R. A. Watkins. Mr. Willis has been long identified with the mining interests of Arizona, serving for several years as director of the Arizona State Bureau of Mines. He accomplished much toward advertising the mines and natural resources of the state by his contributions to the technical journals and in other publications. Mr. Willis has been consulting supervisor of the Department of Industrial Relations of the Phelps Dodge Corporation in which capacity he has represented the corporation before important conferences and conventions of the industrial world.

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Editorials

THE RELATION OF PRICES TO SOCIAL DISTURBANCE

AMPLY FINANCED secret agents of the Bolshevik social cult continue to stalk through Europe, fomenting general and special strikes, seeking the partition of nations, and preaching revolution to soldiers and labor unions while urging that they should not work nor produce until the last sou of profit incidental to the war, whether made legitimately or by profiteers, has been swept away or dissipated. The Scandinavian countries are infected, and Spain, France, Switzerland, Italy and Germany, are suffering from industrial stagnation, first from lack of raw materials, secondly from man shortage, and thirdly from the idleness of workmen who have plenty of money, supplied from Russia.

In many districts of Italy one uproarious fete day has followed another, although the unions have no moneys in their treasuries, and the working folk would never think of living on their savings. Italian workmen and their families spend easy money distributed from Bolshevik headquarters at Genoa, where the Mafia, which once worked hand and glove with the Russian Nihilists of years ago, hand out their share of the golden treasure of the Romanoffs, reputed in Europe to be $750,000,000 worth of the precious metal, which *cache*, it is supposed, has been unearthed by LENIN and TROTZKY. Poland has been standing alone as the buffer between Bolshevism and the West, thanks to IGNACE PADEREWSKI, the Polish idol.

The widespread radical influence exerted on the world, a fact to be reckoned with, not to be ignored, has touched everything in Europe west of the Urals and has spread eastward halfway across Siberia, to Lake Baikal. Returning travelers declare that American troops left Archangel in Russia and quit Siberia, together with the Japanese, to avoid annihilation. The European hope is that the experiment of Bolshevism, which would have been pretty sure to have its trial in Russia in any event, or some other part of the world, will be carried out to its foregone conclusions, while being confined to Russia.

We are reliably advised that continental Europe is only too familiar with the details and the general composition of the drab picture, for nearly every country has its own mental and physical miseries as criteria for the whole. In England, the journalists and publicists with their British habit of glossing over or minimizing disagreeable things, are informed, but are not intimately informing their public. The experiment is to be tried of lifting the Russian blockade, on the initiative of LLOYD GEORGE, to observe the psychological and material results.

As we write, six weeks in advance of publication, Americans have by no means become fully advised. The public is in the dark, although there are well-informed men here and there. A few economists, editors, students and bankers know, but there is no intelligent effort made to discount the future. Europe is infinitely darker industrially and politically than it was a year ago, a few months after the armistice was signed. To state the conditions is not calamity howling, the thinkers declare, but merely a duty to those who would face the facts, for this is a world of cause and effect.

From 3,000 to 4,000 imported propagandists for Bolshevism, and this is a conservative estimate, are still unapprehended in America, following raids and importations. A large percentage of them are Swedes who were pro-German during the war. There are also hundreds of Russians among them. There is a sharp division of opinion whether deportation is a wise move. Sympathizers with radicalism, and those wavering, are felt by many thinkers to be prone to making martyrs out of the devotees, and putting them on communal pedestals. There has been a growing belief, publicly expressed, that it might be better to deprive them of their liberty here, and put them at work on the rock piles and at road building, which would classify them as malefactors against society in America, at least in cases where they have preached the overthrow of the government. The deportees have been sent back to their countries of origin on the theory that where there is a cancer, it is better for surgery to eliminate it, but the opponents of this theory say that nearly always a cancer spreads after an operation anyway.

Sir GEORGE PAISH, the British economist, has estimated that to offset the effects of radicalism and its propaganda in Europe, and to rehabilitate the various countries in the next decade and re-establish their industries, something like $20,000,000,000 in food and raw materials will have to be provided. This, curiously enough, is just about the amount of the estimated inflation of values in the United States during the war, on which the American people will pay six per cent., according to American economists and investigators of after-war effects.

It is urged now that additional governmental credits should not be granted from America to Europe. Investors, it is felt, should supply the money. One reason is the over-expansion here of paper credits; the other is the highly uncertain political situation, not only in America, but everywhere outside of the Far East.

There will be a steadily increasing cry in America, according to the economic authorities, for at least one radical thing, and that is a sharp curtailment in the prices of necessities to the people. Americans at this writing are paying about 32 per cent. in direct and indirect taxation and as a result of high prices.

Manufacturers in the industrial fields are establishing their own stores for their employees, who must pay these skyrocket retail prices, or else go cold and hungry. It is a serious economic, social and political situation which presents itself to those who would have our producers produce, who would squelch radicalism and uphold the principles of our theoretically free and democratic government. The time for Americans to take sober stock of the situation is right now, and our leaders in business, if for no other reason than that of self-preservation, cannot act too promptly in reducing inflation.

HEY DIDDLE DIDDLE AND A ROCKET TO THE MOON

IN THESE days of pessimism, optimism, charges and investigations, gloom and good cheer, it is refreshing to read that Prof. ROBERT H. GODDARD, associate professor of physics at Clark College, Worcester, Mass., has had the time away from pedagogy, high costs and bolsheviks in our midst, to devise and test a new type of multiple-charge, high efficiency rocket of entirely new design for exploring the unknown regions of the upper air. Professor GODDARD intends his rocket shall pass out through the 200-mile belt of air surrounding the earth and later on come back and tell us something of conditions out there, as recorded by its instruments. The best that has been done with recording instruments so far is a height of nineteen miles reached by means of a free balloon.

The Smithsonian Institution at Washington released some sprightly Sabbath comment, to relieve the tedium of dull Monday morning news columns, on the high-riding rocket scheme. Its statement declared that the determining factor of the efficiency of a rocket was the velocity of ejection of the gases due to the explosion of the propelling material. In the case of ordinary or ship rockets, as tested by Professor GODDARD, the velocity of exit of the gases is very low, about a thousand feet per second, giving the rocket an

efficiency of only two per cent. By increasing this velocity, through increasing the proportion of the propelling material to weight of projectile, and through a greatly improved nozzle-shaped passage for the escape of the gases, to about 8,000 feet per second, Professor GODDARD has raised the efficiency of the rocket to nearly 64 per cent.

The Institution's statement said that the great scientific value of Professor GODDARD's experiments lies in the possibility of sending recording apparatus to moderate and extreme altitudes within the earth's atmosphere. The nature of the higher levels of the air has for a long time been a subject of much speculation, as to its chemical composition, temperature, electrical nature, density, ozone content and other qualities. The highest level that has ever been reached up to the present time with recording instruments is about nineteen miles, accomplished with a free balloon.

"As the earth's atmosphere extends some 200 miles out, there is a great unknown region, knowledge of which would greatly benefit the science of meteorology. Weather forecasting, to us the most familiar phase of meteorological research, would undoubtedly be improved if daily observations could be taken in the upper levels of the atmosphere.

"An interesting speculation, described in the publication, arising from Professor GODDARD's work, is on the possibility of sending to the surface of the dark part of the new moon a sufficient amount of the most brilliant flash powder which, being ignited on impact, would be plainly visible in a powerful telescope. This would be the only way possible of proving that the rocket had really left the attraction of the earth, as the apparatus would never come back, once it had escaped that attraction. While this experiment would be of little obvious scientific value, its successful trial would be of great general interest, as the first actual contact between a planet and a satellite.

"Professor GODDARD carried out a large number of experiments, both in vacuo and in air, to discover the best form of explosion chamber and nozzle for the escape of gases, to secure the highest possible velocity of ejection. With the most highly efficient chamber and nozzle as determined from these experiments he was enabled to calculate the initial mass required to raise recording instruments of about one pound in weight, even to the highest levels of the atmosphere. That this initial mass is a very reasonable quantity, using the efficient form of rocket described, may be seen from the following figures:

"To reach 184,500 feet in the air, 3.6 pounds; 377,500 feet, 5.1 pounds; 610,000 feet, 6.4 pounds; 1,228,000 feet, 9.8 pounds; 2,310,000 feet, 12.3 pounds; and to reach beyond the earth's influence, only 1274 pounds initial mass.

"The time of ascent of the rocket would be very short, only six and one-half minutes being required to carry the apparatus up 230 miles, somewhere near the outer limit of the earth's atmosphere. The too rapid descent of the recording instruments could easily be checked by the use of a small parachute.

"Professor GODDARD is at present, under a grant from the Smithsonian Institution, perfecting the reloading mechanism whereby successive charges are inserted in the explosion chamber during its upward flight, and it is hoped shortly to be able to demonstrate the practicability and value of this new type of rocket."

This invention to explore the upper airs, devised in Clark's quiet precincts, must hold a certain amount of fascination for the speculative, though they will be obliged to make brave and frequent use of such words as "might" and "if" in their reasonings and deductive guess work. Still one should not take the attitude of finality that there is the impossible to be overcome in such experiments. A great many things of tremendous importance that had been held theoretically impossible have been actually accomplished by scientists and engineers.

Of all the secondary planets the earth's satellite, the moon, is by far the most interesting and important—at least to us. The moon completes her circuit around the earth in a period whose mean or average length is 27 days, seven hours and 43.2 minutes; but in consequence of her motion in common with the earth around the sun, the mean duration of the lunar month, that is, the time from the new moon to the new moon, is 29 days, twelve hours and 44.05 minutes, called the moon's synodical period. If the moon were motionless in space the moon's orbit would be nearly an ellipse, having the earth in one of the foci; hence her distance from the earth varies during the course of the lunar month.

The mean distance of the moon from the earth is only 238,862 miles. Her maximum distance may reach 252,830 miles, and the least distance to which she can approach this footstool is 221,520 miles. Her diameter is 2,160 miles, or about one-seventh of the earth's diameter, and if we deduct from her distance from the earth the sum of the two radii of the earth and the moon, viz., 3,963 and 1,080 miles, we shall have for the nearest approach of the surfaces of the two bodies a span of 216,477 miles. The moon's orbit is an intricate one, because the earth in moving around the sun carries the moon along with it; hence the latter is sometimes within and sometimes without the earth's orbit. These facts indicate some of the difficulties, in a layman's conception, at least, of shooting a rocket at the surface of the moon.

The moon's orbit form is that of a serpentine curve, always concave toward the sun, and its plane is inclined to the plane of the earth's orbit at an angle of five degrees and nine minutes. In consequence of this our satellite appears sometimes above and sometimes below the plane of the earth's orbit, through which she passes twice in a revolution. It is not necessary to complicate matters further with nodes and eclipses.

The moon always presents the same face to us, which may help Professor GODDARD, and this proves that she revolves on an axis, the time of rotation being exactly equal to the time of revolution around the earth, viz., 27.32166 days. The moon's surface contains about 14,657,000 square miles, or nearly four times the area of Europe. Of interest in connection with the rocket experiment is the fact that the moon has no atmosphere and no water. The suddenness with which the stars are occulted by the moon is regarded as a conclusive proof that a lunar atmosphere does not exist, and the spectroscope furnishes negative evidence of the same character.

The moon is a great interest to most of us at all familiar with its supposed character, which is why we should not smile too complacently over the GODDARD ambition to explode a flash on its surface. In remote ages the lunar surface was doubtless the theatre of violent volcanic action, being elevated into cones and ridges exceeding 20,000 feet in height, and at other places rent into furrows or depressions of corresponding depth. The lunar volcanoes are now extinct. Astronomers picture a profound silence reigning over its desolate and rugged surface; a dead world, utterly unfit, they say, to support animal or vegetable life. It might be a great place in which to recuperate from the nerve rack of New York or Chicago.

So much for thoughts in connection with jumping over the moon. The atmospheric belt outside our own sphere, with which Professor GODDARD would experiment, is nearer and more realizable; and yet not so much is known about it comparatively as one might think. Our sensible atmosphere is generally supposed to extend from 40 to 200 miles outward, but becoming at only a few miles from the surface of too great a tenuity to support life. The conditions and motions of this great aerial ocean play a most important part in the determination of climate, modifying, by absorption, the otherwise intense heat of the sun, and when laden with clouds, hindering the earth from radiating its acquired heat into space.

And for the life of us we don't know what the compressed air machinery industries would do if it were not for this atmospheric ocean! Any new facts gleaned by Professor GODDARD through photographs or instrumental records will be welcomed in scientific and engineering circles, and by our meteorological bureaus.

CATALOGING COMPRESSED AIR DATA IN EUROPE

THE *Cie Parisienne de L'Air Comprimé*, 5 Rue de Liege, Paris, has commenced cataloging all data which has been published in European technical journals and newspapers in reference to compressed air and has written to COMPRESSED AIR MAGAZINE for information on systems of classification existing in the United States.

The French journal *Revere Generale de l'Electricite* accomplished such a classification in reference to electricity using the decimal method known as the Dewey system invented in the United States and the same system was adopted in an extended or modified form in 1895 by the *Institute de Bibliographic de Bruselles*. This latter is known as the Brussells system to differentiate it from the original Dewey method.

At the present time, no such classification

on compressed air exists and undoubtedly the proposed system will prove of great value to engineers and others using compressed air as a power medium.

LIVING COSTS FOR MINERS AND FOR CITY FOLK

MINERS OF West Virginia have not been so much affected by the high costs of living prevalent in most parts of the country, as might be expected, according to the findings of a correspondent of the *Tribune* (New York) which we find quoted and discussed in the *Literary Digest*. Figures collected in the Kanawha district, covering a period of two years, would indicate that by comparison with the larger earnings of the miner in that field, the outlay for maintaining existence has increased by only 2.61 per cent between 1917 and 1919. The increase is much less than that felt by the mechanic, the bank clerk, the carpenter, the preacher, the laborer, or the lawyer living in the cities of West Virginia.

The *Literary Digest* takes pains to note that no account is taken of a possible change in the miners' standard of living during the two-year period, although a change in that regard would invalidate the whole of the table prepared, which we reproduce:

	1917	Or %	1919	Or %
Powder ...	$4,943.78	2.15	$5,873.81	2.02
Coal	1,277.97	.56	1,794.93	.62
Rent	7,174.93	3.13	6,846.37	2.35
Teaming ...	357.46	.15	425.30	.15
Store	52,476.79	22.90	74,843.52	25.77
Doctor	2,400.55	1.05	2,546.49	.88
Lights	219.00	.10	454.20	.16
Union Dues.	2,434.96	1.06	4,412.84	1.52
Funeral and Hospital .	1,401.75	.61	2,476.88	.85
Net cash paid to miners	156,551.41	68.29	190,823.88	65.68
Total ..	$229,238.60	100.00	290,497.57	100.00

The writer of the article quoted explains and comments as follows:

While increased prices for food and clothing have been general, due to a diminished production, the miner in the coal-producing fields of the State has not felt the relentless upward trend of prices that has pinched the pocketbook of the city resident. Although paying increased prices for some commodities the miner has escaped many other burdens that the city-dweller has been forced to count against his earning capacity.

The comparative statement, taken at five mines makes a comparison of earnings and expenditures of the miners during the months of May, June, July, August, September, and October in 1917, six months prior to the Washing agreement, when a 45 per cent. increase was given the miners, and the same six months prior to the general strike which became effective November 1, 1919.

In this compilation of figures a surprising feature to those unfamiliar with the coal industry is that the miner has no rent problem. One of the biggest factors in the cost of living to the residents of cities and towns is rent. For occupancy of a comfortable home with a garden lot the miner is paying the same rent that he paid previous to the war. A five-room house will cost the miner ten dollars a month. A similar house in some localities would cost the tenant from $25 to $50 a month.

Fuel is another commodity which the miner receives from the operator much below the cost of production. When the first day of the month arrives the miner does not receive a statement from a gas company. Instead, the fuel problem of the miner is solved by a monthly charge of from $1.50 to $2 imposed by the company for the coal consumed.

In the comparative statement at the five mines in the Kanawha district it is shown that the store sales are the largest item of expenditure by the miner. In the six months of 1917 expenditures of the miners at this store amounted to 22.9 per cent. of the gross earnings of the miners. In the same six months of 1919 the store expenditures increased to but 25.77 per cent. of the gross earnings. This item of expense included not only the foodstuffs consumed, but such other items as shoes, clothing, furniture.

Another feature brought out in the compilation of expenditures at these mines was the cost of upkeep of the union with which the men are affiliated, for in the six months of 1919 the sum collected in union dues from the miners amounted to 64 per cent. of what the miner paid for house-rent. The miner paid to his union a sum greater than he paid for his fuel and doctor.

After all deductions for coal, rent, store, union dues, and other items were taken from the gross earnings of the miners at these mines they still drew in net cash two-thirds of what they actually earned.

Meantime in the large cities there is little or no let-up in retail trade. The public is not retrenching. The big stores report in the main that they are selling 50 per cent. above last year's prices, too. This is partly owing to price advances.

Retail dealers are approaching the 1920 spring season with a certain amount of caution. Retail prices next spring will show marked advances over those prevailing at this writing, it is predicted. The retailers are paying more for some lines of merchandise to be sold next spring than they are at present charging for similar articles, they assert. This is particularly true of silks, cottons, and shoes, they report.

* * *

Aside from foodstuffs, it is of course freely stated that the greatest profits are being tacked on to the items of shoes and clothing. Economists and statisticians have reported in New York that the cost of the very best men's shoe made in America is $4.50 a pair, including high-priced materials, present high-priced labor, factory sales expense and all overhead. These same shoes sell at retail for $17 or more a pair. In between somebody appears to be making a considerable profit.

A retail store in a New Jersey town was recently visited by a person who selected a suit of clothes that appeared to be satisfactory to him. After examining it with care, he inquired the price of the suit. The salesman, who happened to be a member of the firm, replied that $60 would make it a trade.

"Why this is only a cheap suit," exclaimed the customer. "There is nothing extraordinary about it or its quality or make. Out of curiosity, I'd like to know what this suit cost you from the makers."

"We don't tell our customers our wholesale prices," was the report. "It is none of their business."

"Well, this one is going to make it his business," said the "customer," showing a shield indicating he was a government investigator. "I want to see your bills for these goods," and he headed for the firm's private office in company with the salesman.

The suit selling for $60 had cost the firm $18!

Thirty-three and one-third per cent used to be considered a fair margin of profit, according to investigators, on clothing, although in some instances fifty per cent was charged. Whether there is any justification for asking 200 per cent profit, and that is by no means the limit in some lines of goods, the public seems in a way of finding out.

It is refreshing to find here and there in the country evidences that prices and living costs have not gone beyond the point they might reasonably be expected to reach. We believe the West Virginia miners, however, present an exceptionable case.

There seems to be no doubt, in the main, that the great increase in prices for necessaries of life, does not represent the increase in cost. The prices, our best-informed investigators declare, represent what the dealer thinks he can get, so a good deal of the responsibility appears to be up to the purchaser. At the same time retailers and producers of the necessaries of life have a heavy burden of responsibility resting upon them, and open-minded students of economy and of sociology freely assert that if the more far-seeing business men do not voluntarily lower retail prices that serious political events may result.

FREE HEAT AND LIGHT FOUND BY HOPEFUL SCIENTIST?

HEAT, light and power free in every household would seem to be in the realm of possibilities, if the method described by H. H. PLATT, a mechanical engineer of Philadelphia in an address before the American Association for the Advancement of Science, is practicable. Mr. PLATT insisted that sufficient energy could be extracted from the air by his process to heat houses. He urged the scientists to aid in developing this new source of fuel "so as to relieve coal-oppressed humanity."

The device suggested to utilize the energy contained in sunlight consists of a very thin sheet of metal perforated with many small holes, which are prepared in such a way that air molecules, bearing energy, will pass through it more easily in one direction than in the other.

According to the accepted theory, the pressure which air exerts on a given surface is the sum of the impacts on it of rapidly moving molecules. If these molecules can pass through a sheet of metal more readily in one direction than in the other the result would be a slightly unequal pressure and the sheet of metal would tend to move toward the side of least pressure.

By mounting a number of such "partly irreversible permeable membranes" on a shaft like paddles on a mill-wheel, PLATT asserted, a compact and powerful engine could be produced. The paddle-wheel would turn, generating power through its axis and at the same time removing heat energy from the air passing through its leaves—a feature that would make it adaptable for use as a refrigerating machine.

Mr. PLATT depicted the householder of the future possessing a cheap machine which will furnish light, heat and power, and produce cold air for cooling the house in summer. The operating cost would be nothing.

We are unable just yet to accept the idea of fulfillment of Mr. PLATT's programme in toto. As a matter of fact, it is a little difficult to follow the rapidity with which the various benefits to humanity would follow. It seems plain that if heat is transferred from one place to another, there will be a rise in temperature at the destination of the thermal units, with a corresponding drop at the point of withdrawal, providing the process should prove 100 per cent efficient. Thus will the Philadelphia scientist obtain the advantage of refrigeration where it is needed, while supplying warmth so welcome to the oppressed rent-payer, at the same time, to say nothing of the light that the anti-daylight-savers deny us.

Some one has said that "rubbish is only matter out of place." Apparently this invention bids fair, in theory at least, to clean up a good deal of the uneconomical distribution of heat units in the world.

EDUCATING PUBLIC OPINION ON AMERICAN INDUSTRIES

THE TENOR of the remarks of the principal speaker at the first annual dinner of the New York Railroad Club, Mr. JOB E. HEDGES, was the imperative necessity on the part of the various great American industries to educate public opinion to the conditions under which they are compelled to function.

Wherein the railroads have fallen down, Mr. HEDGES pointed out was their failure to educate the public. When railroads are in trouble, it is too late, as their motives are then open to suspicion. The most trying and most necessary problem under our form of government is to educate public opinion on any topic. Continuing, the speaker said it is impossible for the general public to understand all the problems affecting the public, but this does not prevent someone talking glibly about appealing to public opinion every now and then.

Mr. HEDGES summed up the situation by the statement that "every big industry of the United States will never be permanently successful unless it educates its own general public and does this as it grows."

It has often been remarked that "public opinion is the greatest force in the United States" and that one can't go against universal prevailing sentiment. However, the latter statement presume the existence of such a public consciousness of current questions where such is absent; then the public is at the mercy of the orator and others who out of selfish motives for personal advancement find it to their interest to misstate facts.

It therefore behooves each industry to see that its problems, including questions of wages, reasonable return on investment, relations between employer and employee, are presented to the public, not when the industry has become beset with difficulties and is in the process of disorganization, but during the time of its growth. Then the hundred odd millions of population will have the opportunity of passing an enlightened judgment on all such questions which will assuredly be just and also considerate.

THE TECHNICAL PRESS AND THE IRISH QUESTION

WE ARE indebted to our neighbor, the *Metal Trades*, for its comment on a subject which is one of considerable delicacy with Americans these days. When the Prince of Wales was the guest of the City of New York, as well as of the great state of which New York is the metropolis, he was welcomed at our historic city hall and granted the freedom and the courtesies of the city in terms which the great mass of the people of the city and state accepted as being sincere. About two months thereafter, the city, state, and nation observed a contrasting event in which the chief magistrate of the City of New York welcomed "President" de Valera of the so-called Irish republic, and became a sponsor of a movement to raise a ten-million-dollar fund in the advancement of a cause having nothing to do with the administration of good municipal government, and one calculated to stir up feeling and division of opinion.

Regardless of the merits or demerits of arguments on both sides of the entire Irish question, but bearing directly on the propaganda now flooding editorial offices, we believe that the United States is not the place to fight out the Irish question.

We are therefore glad to reprint the comments of the editor of *Metal Trades*:

"We are in receipt of a bulky mass of propaganda, which we assume is being sent generally to periodicals of all kinds, from the so-called 'Friends of Irish Freedom.' We also assume that they wish us to comment upon it, which we will do. We know a great many Englishmen and a great many Irishmen. Individually, most of them are fine men. We are truly sorry that, collectively, the English and the Irish are not getting along well together in their own country. If certain Irishmen wish to plot against the British government, that is their privilege. If the British government chooses to defend itself against these Irishmen, that is its privilege. The only interest that we as Americans should feel in the discussion of 'self-determination for Ireland,' without, mind you, self-determination for Ulster, other than as friendly a feeling as possible for all parties concerned, is that the entire dispute should be kept where it belongs, and not carried to the United States, as the 'Friends of Irish Freedom' are trying to do. Such an attempt is as much out of place as an attempt by British subjects to interfere in our negro question or Indian question would be. There is, however, another aspect of the case that deserves mention. We have indisputable proof that during the War the leaders of the Sinn Fein movement did all they could to help the Germans, and that some of them, at least, connived at attempts to murder our soldiers and sailors on the high seas. Their utterances therefore should have the same consideration, and no more, as that given to the statements of other convicted, but unfortunately, unpunished criminals."

Scientific and technical education suffers in pedagogy and administration through the untimely taking off of Dr. RICHARD C. MACLAURIN, president of the Massachusetts Institute of Technology, or "Boston Tech," famed throughout the world of engineering. Pneumonia claimed him at forty-nine, while he was arranging at New York for the jubilee dinner of the Institute. Born in Lindean, Scotland, on June 5, 1870, his boyhood was spent in New Zealand, where he was educated in elementals in the Auckland schools. He later took his B. A. and M. A. degrees at Cambridge, afterward receiving the degree of LL.D. from both Harvard and Cambridge, as well as other universities. He was Smith prize man in mathematics at Cambridge in 1897 and Yorke prize man in law in 1898. After travel in Canada and the United States he became professor of mathematics at the University of New Zealand, becoming a trustee and taking a leading part in technical education in the Antipodese. In 1907, Dr. MACLARIN returned to America to stay, becoming professor of mathematical physics at Columbia, and afterwards resigning his chair to become president of the Massachusetts Instituite, which post he held until his death. He was responsible for and carried through the remarkably successful campaign whcih has placed that great school on its present pinnacle of achievement.

The great house of E. I. du Pont de Nemours & Co. has announced the development of a new anaesthetic which eliminates pain in the dressing of wounds, in obstetrical cases and in dentistry, while there is no loss of consciousness in the patient. It is described as a new type of ether that is highly refined and modified by addition of certain gases that provide its peculiar characteristics. If it will remove pain in nerve treating, removing of roots and drilling and filling of teeth, as declared, it will have our heartiest approval. Tests in hospitals and clinics are said to have demonstrated that the new anaesthetic is practical and that its use is followed by no undesirable results.

The late LAFCADIO HEARN wrote of the delightful impermanency of Japanese life. He would be shocked no doubt to witness the introduction of American steel and concrete skyscrapers, hotels and apartment houses in Tokyo and Yokahama. It was lately announced that a New York firm had obtained a $5,000,000 contract for modern fireproof structures in Japan and that the sky line there was to be

invigorated with the picture of American riveter and structural steel handlers suspended between earth and sky on big girders hundreds of feet above the heads of the populace while the racket of the air hammer smote the ear. There are astonishing possibilities in the thought of the West advancing to the Far East.

Prof. A. B. HART of Harvard urges the United States speedily to become prepared for, and constantly to be on the alert for the signs of another great war, which he says is certain to come in the next decade. He says it would be criminal for us not to be prepared the next time. JAMES HAMILTON LEWIS, formerly U. S. Senator from Illinois, says we may be in some sort of war within a year. Mr. ROOSEVELT, Assistant Secretary of the Navy, unhesitatingly declares we must have sea force equal at least to that of the present most powerful navy, as we now have few friends among foreign nations because of our superior economic situation. The war-preventive features of the League of Nations have not yet begun to function apparently—in men's minds, at least—and in any event America is not yet a member of the league, unfortunately. America does not love militarism, but it demands the preparation that is a part of eternal vigilance.

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Reconstruction Days

In the interest of a substantial business policy, apart from the motives of sentiment and humanity, America's financial aid to Europe as well as foreign commerce was discussed at a recent luncheon given by the Allied Machinery Centre, Walker and Center Streets, New York. The luncheon, which was attended by a large number of prominent bankers and manufacturers, was to celebrate the opening of the New Centre which is a non-competitive export selling group of large manufacturers. The speakers were Joshua W. Alexander, Secretary of the Department of Commerce; Senator Walter E. Edge, of New Jersey, and George Edward Smith, former President of the American Manufacturers' Export Association. Charles F. Lang, president of the Lakewood Engineering Company, was toastmaster. Secretary Alexander said that his department intended holding a meeting every two weeks with the United States Shipping Board to further the interests of foreign trade. He said it was imperative that America increase its cargo and passenger tonnage. He advocated the taking over of shipping by private owners.

A provision in the McFadden silver bill introduced in the House of Representatives would reduce the percentage of silver contained in subsidiary coins in order to prevent their being melted down by reason of an increase in the price of the metal. On February 12, 1873, the gross weight of a silver half-dollar was fixed at 192.90 grains, nine-tenths fine, which makes the pure silver content in the coin equal to 173.61 grains. Thus there are only 347.22 grains of silver in two silver half-dollars, as against 371.25 grains in a silver dollar. The gold value of 347.22 grains of silver is $1 when the price of silver touches $1.38 an ounce, while the gold value of 371.25 grains is $1 when the price of silver is $1.29. The silver quarter and dime have the same proportionate silver content as the half-dollar, and accordingly have the same parity of $1.38.

Some details were recently given in *Le Génie Civil* of the methods employed in the Navy for sounding the depth of the sea by means of explosive charges. A small explosive charge is detonated in the water alongside the vessel in motion. A microphone immersed to a slight depth and fixed to the boat at a known distance from the point of explosion first of all collects the detonation and then the echo reflected from the bottom of the sea. These two sounds are recorded on a chronograph, which so permits the interval of time separating the two sounds being read with great accuracy. The time interval and the mean speed of the sound in the water being known, a simple formula gives the depth of the water. Experiments carried out in the Channel at depths between 60 and 100 metres gave satisfactory results.

Gold exported from the United States during the calendar year 1919 amounted to $368,144,545, according to a report just made public by the Federal Reserve Board. Imports of the metal during the year amounted to $76,534,046. Excess of exports over imports amounted to $291,610,499, being the largest excess of exports on record. Total exports for the year were the second largest on record, the banner year being in 1917.

Of the total exports of $368,144,545 gold in 1919, $94,114,189 went to Japan, $56,560,000 to Argentina, $40,045,266 to Hongkong, $39,109,769 to China, $34,300,660 to British India, and $29,778,000 to Spain. Importers totalled $76,534,046, most of it coming from Canada and Hongkong.

Silver exports were valued at $239,001,051, British India taking $109,180,718, China $77,583,367, and Hongkong $10,225.351 for coinage purposes. The growing European demand for silver for currency, was shown in $15,635,386, exports of silver to England, $6,583,197 to France, and $2,094,084 to the Netherlands. Imports of silver were $89,389,536, of which $63,303,437 came from Mexico.

Credit inflation is world-wide according to the monthly letter of the National City Bank, which calls attention to the recent action of the Bank of England in raising its discount rates as being indicative of the situation in that country.

"The fundamental fact," says the bank, "is that there has been no relief in commodity markets since hostilities ceased a year ago. Production has not been resumed upon a scale adequate to meet the world's needs, and with the demands of labor for lighter pay and shorter hours the pressure for more credit has been insistent everywhere. One remedy is to make credit more costly, and this must be generally applied, but there is another, which is to exercise greater discrimination in lending. This must be done, of course, with care, not to force liquidation in a drastic manner, but to hold the tendency to expansion in check. The situation probably is at or past the crest of the present demand, and after the opening of the new year may be expected to show some relaxation, although a state of ease is not to be expected until prices turn lower."

An ingenious method of destroying small bridges used by the Germans in their war operations consisted in making a girdle of 12 to 15 hand grenades around each pile, putting a cap in one of them and connecting them up to a battery. Upon firing, the pile would be cut off and down would come the bridge. The grenades used for the purpose were those with the handle for throwing, called by the American doughboys "potato mashers."

For years Peru has had great silver mines. It is an ancient industry of the country, but the value of the metal made the work only slightly profitable. Recent advances in its price have witnessed the reopening of these mines, with the employment of many men at good wages, and the development of a profitable and extensive business.

Book Reviews

FLOW AND MEASUREMENT OF AIR AND GASES, by ALEC B. EASON, M. A., Associate Member of the (British) Institute of Electrical Engineers. Folding plates and other illustrations. Many formulae and charts. Contains name index of some 250 quoted authorities on air and gas, and a subject index. 252 pages. Price, $7.50. London: Messrs. Charles Griffin & Co., Ltd. Philadelphia: Messrs. J. B. Lippincott Company.

HERE IS ONE of the most valuable and most important books pertaining to compressed air that has appeared in years, and we predict that it will speedily find its place on every shelf pretending to contain compressed air literature. Its subject is specific and the writer-editor-compiler does not get far afield from it. With regard to both air and gas flow he has laid an indispensable collection of fact and the soundest theory available before engineers, indicating at the same time where more detailed information on the various subjects may be found. The author indicates that the references are purposely given fully, so that readers may consult the originals if they wish. An attempt has also been made to coördinate the results of various tests and formulae, so that the reason for variations may be appreciated.

As an instance, Mr. Eason shows many references to the coefficient of friction in reports, but the extraordinary variations in its value are indicated in certain figures and tables, whereas some authorities take it as constant. For those who are ready to accept any formula, without caring how it is arrived at, or what values of the constants are included, this book, our writer observes, may not perhaps be of much interest, as it is largely concerned with those very points. But for those who want to know upon what foundations, graphs and formulae are based, it should be of value.

As regards subject matter, Chapters II and III, entitled respectively "Coefficient of Friction in Pipes" and "Loss of Pressure at Fittings," deal with the flow in the pipes; Chapters IV to VI deal chiefly with pneumatic tube problems; Chapters VIII to X consider the measurement of air and gas, about which little information is given in books on air compressors, and include a description of the recent development of hot-wire anemometers; the concluding chapters, XI to XIV, inclusive, consider subsidiary questions relating to air flow.

Some of the graphs are found to be plotted on logarithmically ruled paper, which the author thinks should be better known in England. A few abaci are included, these being a convenient form of graphical chart. The metric symbols cm, kg, and m, it is to be noted, are printed without the full stop, or period, as is customary in French and German journals.

In explanation of any errata that may have crept into the formulae and tables, Mr. Eason states that the constants in the formulae have only been calculated upon a slide rule and may in instances be one-half of one per cent. out! Such inaccuracy, however, is immaterial in ordinary air and gas work, as the varying conditions of the atmosphere cause the specific volume of air to vary much more than one-half of one per cent. from day to day, or even from hour to hour. Many engineers are happy if they can get within twenty or 25 per cent. of accuracy.

The tables contained in the book on air compression are of singular value, as are other groups of practical data, and we venture the prediction that few practising engineers will care to be without it, once its value becomes known. We commend the modest author for his work, for he has made the entire field of compressed air practise his debtor.

PRINCIPLES OF DEPRECIATION, by EARL A. SALIERS, Ph. D., Assistant Professor of Accounting, Sheffield Scientific School of Yale University. Fourth printing. Indexed and with bibliography, tables, logarithms and charts. 200 pages. Price, $3. New York: The Ronald Press Company.

THIS BOOK, which has enjoyed several printings, covers a general subject that has had great attention in late years from accountants, engineers and those interested in the pecuniary and mechanical problems of modern corporate enterprise, and who of necessity must study the economics of business with a view to increased efficiency, safety, and justice in the complex field of industry.

The work undertakes a study of the depreciation of capital values, which in their manifold forms constitute a large share of the world's wealth. The author presents what is oftentimes regarded as an abstract and theoretical problem, as one that is really intensely practical. An unavoidable problem, any objection offered on the score of the indefiniteness of depreciation, is outweighed, as Dr. Saliers observes, by the necessity of mastering it.

He views the problems offered from two angles—that of the accountant and that of the engineer, the latter dealing with physical conditions, deterioration and replacement, and the former with means of recording intelligently the facts regarding the changes. It is shown that the work of the two should be correlated through a common understanding of the character and extent of depreciation.

The engineer shows the rate of depreciation; the accountant records it and provides replacement funds for the preservation of capital value. The book suggests suitable methods of determining annual depreciation charges, some of which require computations involving algebraic formulae. These formulae are fully explained with sample solutions and graphic charts.

To report intelligently to the government on income tax returns, business men should study the depreciation subject with care. More lies in it than many manufacturers may have suspected. Much space is given in the book to the important phase of depreciation in relation to income taxation.

New Mining Treatises

The Bureau of Mines, Department of the Interior, has issued a new list of publications (List 72—January, 1920) as follows:

Bulletin 175—*Experiment stations of the Bureau of Mines*, by Van H. Manning, 1919.

Bulletin 181—*Abstracts of Current Decisions on Mines and Mining, reported from January to May*, 1919, by J. W. Thompson, 1919.

Technical Paper 210—*An Analytical Method for Detecting Blown-out Shots in Coal Mines*, by G. F. Hutchison and H. Barab, 1919.

Technical Paper 211—*Quantitative Microscopy of Powdered Ores*, by W. H. Coghill and J. P. Bonardi, 1919.

Technical Paper 237—*Safe Practice in Using Wire Ropes in Mines*, by O. P. Hood and R. H. Kudlich, 1919.

Miners' Circular 26—*Miners' Safety and Health Almanac for* 1920, by R. C. Williams, 1919.

These publications are distributed free and should be ordered by number and title from the Director of the Bureau of Mines, Washington, D. C.

LABOR AND THE COMMON WELFARE, by SAMUEL GOMPERS, President of the American Federation of Labor and Vice President of the National Civic Association. Edited and compiled by Hayes Robbins. Indexed. Price, $3, net. New York: Messrs. E. P. Dutton & Co.

WHETHER one agrees with, or does not agree with, all of the tenets of Mr. Samuel Gompers, head of the American Federation of Labor, and one of the world's most intelligent labor leaders, he will find highly interesting material in his book on labor movements and labor problems in America, which is a compilation of his speeches, articles and public expressions. The volume we have before us comprises a review of American and general social problems from the viewpoint of Mr. Gompers and as he has intimately known them in the course of the last 35 years. It contains his views as applied to such subjects in these days of world reconstruction. Mr. Robbins, in his foreword to the volume, appraises Mr. Gompers as "the world's first industrial statesman," which he undoubtedly is, at least on one side of the labor fence. He has unquestionably left his impress on the times. Ray Stannard Baker, in one of a recent series of articles in the NEW YORK *Evening Post*, has described Mr. Gompers as the "type-figure of American Labor * * * the most powerful and dominating leader America ever had, * * * but today in great trouble." But, as Mr. Baker adds, all leaders are in trouble. Wilson is in trouble, so is Lloyd George. And for a simple reason: followers will not follow. Publics have gotten out of bounds; they will not stay in old party lines, nor yet in old union lines; they challenge authority and discipline. They gibe at institutions.

So Mr. Gompers is painted as one of the extraordinary men in America today, "not only the arch-type of a movement, but a character, a personage." Labor organization has tended to become institutionalized—the church of labor, and Gompers is the pope of it. The leaders are a very definite type—practical, efficient, unimaginative business men. A group of labor leaders of successful craft unions cannot be distinguished today from any ordinary group of American business men. The headquarters of the A. F. of L. is its own sky-

scraper in Washington, these days, not too far from the seats of national legislation.

The contents of the Gompers book, edited by Hayes Robbins, and compiled by the latter, are of educational importance, it seems to us, to every industrial manager, to all industrians, to college professors, publicists and law-makers; and ignoring or setting aside the utterances of so compelling a figure as Mr. Gompers, who has taken his stand on the side of conservatism, as opposed to radicalism and revolutionism, is turning one's back on problems that eventually must be faced, and this without special regard for the discussion of closed vs. open shop.

OFFICE TRAINING AND STANDARDS, by FRANK C. MCCLELLAND. Illustrated with charts and photographs, and containing bibliography and index. 283 pages. Price, $4. Chicago, New York and London: Messrs. A. W. Shaw Company.

LOOK OUT, it's coming! Here is frankly another book on the dread subject of EFFICIENCY. But it will win your admiration, if you are not too old-fogeyish and it may save your organization at headquarters time, money and muddling. Prohibition has been laid at the door of efficiency, and the Eighteenth Amendment has proven that when Efficiency with a capital "E" gets in action it can be pretty efficient. All the alleged wit, the expressions of sorrow, the kicks over curtailment of personal liberty, and prophecy regarding its doleful outcome, will not make a particle of difference regarding prohibition. It is a fact; it is here; and efficiency did it. About a dozen highly efficient Master Minds in America decided on prohibition and put it across by efficiency methods, whereas the Prohibition Party hadn't been able to reach the goal in the course of an entire generation.

Mr. McClelland has gotten together a good book on office efficiency; on training folk to get the best results, and on the fixation of certain standards. It is a book that will require a lot of faithful study to get the best results out of it; in other words, it will require a certain amount of efficiency to start with to obtain office efficiency. Chapters are devoted to subjects on which all ambitious office workers will wish to be informed, for it is a recapitulation of methods employed in the most progressive offices of the country. As far as the individual worker is concerned, it will enable him to short-cut that period of training when his services are of little value and help him to rise quickly to a position of greater responsibility. The clerk who aspires to ousting the office manager from his job some day will want to soak up all the information this book offers. And he will make a big hit with the present office manager if he does; that is, if he acquires the information.

FOREIGN EXCHANGE, by ALBERT C. WHITAKER, Professor of Economics, Stanford University. With subject index and list of authorities. 650 pages. Price, $5. New York and London: Messrs. D. Appleton & Co.

PROFESSOR Whitaker's book, lately announced by Appleton, comes out almost simultaneously with the inauguration of the new foreign exchange and foreign trade ticker service in New York, at a time when its subject matter is of compelling interest to thousands of bankers, brokers, exporters and importers and to serious students of international economics. It will also be found to be the most important permanent contribution extant to the literature available on foreign exchange.

It is a subject so intricate that few would feel capable of treating it with the precision and in the detail it merits. Dr. Whitaker has presented a work that embodies a fine analysis and clarification of foreign exchange. It carries the reader through the uses of the bill of exchange and to a knowledge of the more involved operations of foreign settlements as worked out in actual practice, a literary labor not heretofore undertaken, as far as we have noted.

The book is indispensable to every banking institution or dealer in exchange, and it is bound to find an honored place as a text in university courses on finance and economics. The principles set forth are lucidly illustrated with practical examples. Even a cursory perusal reveals that it provides answers for daily problems in foreign exchange. All office libraries of manufacturers and commission houses having overseas dealings should fortify themselves with a copy. Speculators and investors in foreign exchange, and they are legion these days, will surely want a peep into Professor Whitaker's chapters on these subjects.

F. J. T.

HARRY LAUDER, A COAL MINER IN HIS YOUNGER DAYS

THE FOLLOWING is from a most interesting interview with the world famous and altogether unique Scotch entertainer, Sir Harry Lauder as reported by Fred Lackley of *The Oregon Journal.* The interview was carried on during the making-up for an evening's appearance at Los Angeles.

As he doffed his street garb and got ready to don his kilts I said, "How did you get those bulging muscles?" He said: "Feel my leg. Now feel my arm. Solid, eh? I got that working at the face of the seam in a coal-mine as a coal-hewer. I keep fit by constant exercise. When I am not on the road I cut down trees and work them up into firewood, dig ditches, and keep in physical trim. I am five feet, three inches tall. I weigh 170 pounds. My chest is 42 inches around. My waist much less.

"My middle name is MacLennon. That was my mother's maiden name. My mother's clan was from the Black Isle, in the north of Scotland. That's it; my full name is Harry MacLennon Lauder. My father was a potter. He made pots and jars and other clay articles by hand. I was born at Portobello, near Edinburgh, August 14, 1870. My father's earnings were meager. There were many mouths to feed. There were seven in our family—five boys and two girls.

"If you have been in Scotland you know that at Dundee, at Fife, and at Arbroath there are flax-mills. When I was eleven past I went to work in the flax-mills at Arbroath as a flax-dresser. We got our raw flax from Russia. I was a half-timer. Most of the lads and

(C) Underwood & Underwood, N. Y. City.
Sir Harry Lauder

lassies thereabout were half-timers. We went to school every other day. I was paid two shillings and a penny a week, which went into the family fund.

"For a year I worked as flax-dresser at Arbroath; then my people moved to a colliery district near Hamilton in Lanarkshire, and I went to work as a trapper in the coal-mines. It was my job to open the trap-door and let the pony with a load of empties come in and the pony with the full rake of cars of coal come out. I spent ten years at work underground. From trapper I rose to be driver, and then to coal-hewer.

"I worked under a man whose daughter I later married. Annie Vallance was my wife's maiden name.

"Even when I was a wee laddie I was fond of singing. I used to sing at contests and at amateur recitals. Finally I became so much in demand that when they had me sing and recite at paid entertainments they offered me two shillings and sixpence for my evening's program. Did I take it? Why, man, I flew at it like a cock at a ripe gooseberry. After two years I raised my price to five shillings for an evening's program. Two years later I raised to seven shillings and sixpence for my services. Many's the week I would put in three evenings at that figure. With what I earned at singing and reciting, added to the thirty shillings a week I made as a coal-miner, I saw I was on the high road to fortune.

"I did my last work as a coal-miner in June, 1894. I quit my job in the mine to go on the road as a Scotch comedian, with the Kennedys, the Scottish entertainers.

"I was fourteen when I first started going with Annie. She was eighteen and I twenty when we were married, 29 years ago, by the Rev. Dr. Wallace, the Presbyterian dominie. I mind when I was going with her I said to her one night, 'Annie, if you will marry me I'll make you a lady some day.' I was always joking. She squeezed my arm and said, 'I'll have you anyway, Harry, lady or no lady.' We were in Australia when word came to me that the King had made me Knight Commander of the British Empire. That meant that I became Sir Harry Lauder and that my wife was Lady Lauder. There flashed into my memory what I had said to Annie so long ago. I turned to her and said, 'Well, Annie, dear love, I told you I'd make you a lady, and I have kept my word.' She said, 'I never doubted but you would, Harry.'"

THE LARGEST CREATURE THAT EVER INHABITED THE AIR

THE LARGEST creature that ever inhabited the air, so far as known to science, was the *pteranodon*, of the *pterodactyl* class, which existed millions of years ago in what is called the Age of Reptiles. The *pteranodon* was a flying reptile or lizard, and before it became extinct in America, was without teeth. It had a wing spread of sixteen feet, and would have measured 21 feet from tip to tip if its wings were pulled out straight. The largest of our modern condors measure only about thirteen feet from tip to tip, when their wings are pulled out straight.

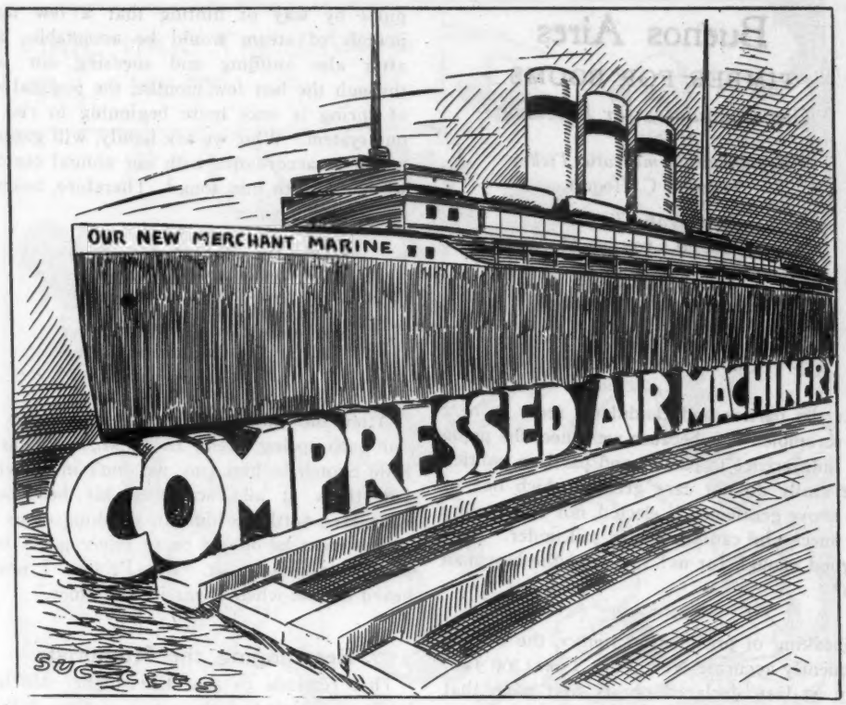
A mounted speciment of the *pteranodon*, believed to be the only one in the United States, was placed on exhibit recently at the American Museum of Natural History, New York City. The remains were found in the cretaceous chalk beds of the Smoky Hill River district of Western Kansas, by Mr. Handel T. Martin, curator of the Geological Museum of Kansas University, a collector of fossils. He also found the other specimen of *pteranodon* which is in the British Museum.

Dr. W. D. Matthew, curator of the department of vertebrate paleontology of the American Museum of Natural History, makes some interesting observations on the *pteranodon*. He says the wings were long and narrow, and composed of thin, leathery membrane like the wings of bats, but they were stretched on the long extended fourth finger only, the other fingers being little rudimentary claws, by which the animal probably hung when at rest. The wings were evidently adapted to soaring flight like that of the albatross. In fact, the creature was so extremely specialized along this line that it must have been singularly awkward and ungainly on the ground. Yet it must have come to land at times for egg laying purposes. How it obtained its food is something of a problem. It was evidently a wide-ranging ocean flyer, for the skeletons are found in chalk and other marine formations deposited in the open sea far from land.

Kansas, where Mr. Martin found the American Museum specimen, was once part of a great inland sea that stretched from the Gulf of Mexico far across the Canadian border. Over this vast interior sea, deep and clear and abounding in marine life, the *pterodactyl* must have ranged, resorting to the far-off shores as a base. It is possible that it was in some way equipped for diving and for rising easily from the surface of the ocean, but it is difficult to see how the mechanics of its construction would allow it to do so readily, and it may have simply patrolled the air, snapping up such animals as might rise to the surface or leap above it, into reach, without actually coming down upon the water. Such guesses as these are the best we can give until the mechanics of the creature's flight have been more thoroughly worked out.

A careful investigation of the problem in the light of modern aeronautical knowledge would yield very interesting results, and, in turn, it seems altogether probable that such a research would throw some light on the more practical problems of aeronautics, for the *pterodactyl*, in so far as we can judge, approached much nearer to the airplane in structure and principles of flight than any of the birds.

One may find an interesting restoration of the *pteranodon*, or the *rhamphorhynchus phyllurus*, by O. C. Marsh, in an illustration in the Encyclopaedia Britannica, Vol 22, eleventh edition, P. 616.



GREASING THE PRODUCTION WAYS

NOVEL ARRANGEMENTS FOR SAFE STORAGE OF COAL

A novel method of storing bituminous coal in carbonic acid gas (CO_2) which combines the advantages of the overhead bunker with the absolute safety of storage under water against spontaneous ignition has been adopted in an installation recently erected at Dortmund, in Germany. It consists of three cylindrical bunkers—with semi-spherical tops and bottoms—each bunker holding 2,500 tons of coal. There are three outlets in each bunker for withdrawing the coal, and three holes at the top for receiving it; the lower outlets close gas-tight, whilst those on the top, though requiring a good fit, need not necessarily be gas-tight, since carbonic acid gas is nearly twice the weight of air, and does not therefore escape at the top. A simple structural steel tower unloads the coal by grab from a barge; the coal is then shot into a small hopper from which it is fed on to a pushplate conveyor, the path of which completely envelops the three bunkers in the vertical plane. It can therefore both feed and reclaim the coal. There is a slight leakage of carbonic acid gas during the withdrawal of the coal, but this is stated to be small and can be easily replenished.

Albert Schmid, widely known electrical and mechanical engineer, and for many years with the Westinghouse Electric Company, died recently in New York. Born in Switzerland sixty-two years ago, he came to the United States in 1882 and became a citizen shortly afterward. Mr. Schmid associated himself with the Westinghouse Company at the instance of the late George Westinghouse, and was its first chief engineer and later became general superintendent. His skill in designing electrical apparatus contributed very largely to the early success of the alternating current electric system, and to railway apparatus.

When the European Westinghouse electric companies were organized Mr. Schmid was designated for important work abroad, and continued thereafter to occupy important executive positions in them, residing in France for a number of years.

Buenos Aires

TIMBER FOR BOOMS

Our Candidates for President

Republican-Democratic Ticket
HERBERT C. HOOVER

Democratic Ticket
Major General LEONARD M. WOOD

Republican Ticket
General JOHN J. PERSHING

Socialist Ticket
Gov. CALVIN COOLIDGE

If the parties and candidates seem to be a bit scrambled it is because we reflect the popular indifference to parties and partisan politics. We really do not care greatly which one of the above gentlemen is elected, nor what colors the successful candidate may sail under. Each is good enough for us! So, may the best man win!

Speaking of presidential *timber*, the not infrequently accurate New York *Times*, on January 23 last, declared on its first page that Julius Barnes, Director of the United States Grain Corporation, "more than any other individual in New York, was responsible for starting the Hoover *boom*. He launched it two weeks ago at a dinner of the National Wholesale Dry Goods Association at the Waldorf."

Shucks! Nothing of the sort. Mr. Barnes was merely late in joining in the chorus. The *Times* should consult its own files. Besides, the late Archibald Clavering Gunter to the contrary, it's not *Mr. Barnes of New York*, but "Mr. Barnes of Duluth." After Mr. Hoover returned from his labors abroad the first big dinner given for him in this country was that of the American Institute of Mining and Metallurgical Engineers (of which Mr. Hoover was later elected president) and on that occasion at the Waldorf (that part was accurate) COMPRESSED AIR MAGAZINE launched the Hoover boom through its president, who presided at the dinner and delivered a glowing eulogy on Mr. Hoover. When our spokesman suggested a great engineer should be the captain of the "Ship of State," the 1,300 engineers and guests present (led by ourself) stood up on their hind legs and cheered uproariously. COMPRESSED AIR MAGAZINE beat Mr. Barnes to it by two months, and we have 1,300 reputable witnesses, including the modest Mr. Hoover himself, to prove it. So we will be obliged to the *Times* if it will recant. We are glad Mr. Barnes (of Duluth) seconded the motion, though we can't give him initial honors.

Our Annual Poem on Spring

After listening all winter to snow shovels a'shishing and a'shashing on the cement walks, after timorously, and most always unavailingly, adding our own raps to the rapping of other long-shivering tenants on the steam pipes by way of hinting that a few more pounds of steam would be acceptable; and after also sniffling and sneezing our way through the last few months, the poetical sap of spring is once more beginning to rise in our system. Who, we ask boldly, will gainsay us, if, in accordance with our annual custom, we burst forth into song? Therefore, hearing no detaining voice:

Spring the time of springtime—
It can't be sprung too soon—
Bring the birds in wing time,
Bring the hour of ring time
And spooning 'neath the moon:
Spring the time of springtime!

After the third reading in manuscript of our 1920 spring poem, E. P. M., who has a little Scotch in him (no, we don't mean what you think at all) scratched his head and whispered softly to himself, speaking of us:

"He must be one of those *miner* poets he's always talking about. But I'll say I never heard of him when I was in the mines."

Rearranging the Humorists

That reminds us that Christopher Morley, lately associated with our sometime fellow musketeer, Dave Smiley, on the staff of the *Evening Ledger* of Philadelphia, is joining the ranks of the New York City daily column conductors, taking his punch and typewriter in hand for the *Evening Post*. Morley will be more than welcome to *Post* readers, especially those that have occasionally scanned the Teutonic wit usually found in the "At a Venture" column. Mr. Morley will be quite likely to set a pace for, or at least accelerate the pace of his friend and admirer, Don Marquis of the *Evening Sun*. Both are minor poets, paragraphers and punsters of first rank and help to make newspaper browsing bearable. Now, if the New York *Times* would only have Benjamin de Casseres run a column on its editorial page in opposition to F. P. Adams of the *Tribune*, we could look forward to a speedy restoration of America's mental aplomb, what with Moulton of the *Mail* and Phillips of the *Globe*. We wish Jimmy Montague would spread out a little with his "More Truth Than Poetry" in the *World*, and while suggesting things, why would it not be a good notion for Mr. Munsey to hire Bugs Baer or Bide Dudley to do a column for the *Sun* and *New York Herald*. Shades of Bennett and Dana, you say! *Pour quoi?* Baer would distract attention from the way *Herald* editorial writers have violated Mr. Bennett's own list of 300 "Don'ts for Copy Readers and Editors," and Dudley would make one forget the *Sun*'s traction editorials! Everybody would be happier.

Christopher Morley's new book, *Mince Pie*, which is an assemblage of the witticisms of his column in *The Evening Ledger*, is described by Mr. De Casseres as "a mess of fifty highly readable and easily digested essays." In commenting on Morley and his *Mince Pie*, Mr. De Casseres said that the former was "the clean up man of American literature," and that he had gathered into *Mince Pie* with his titanic carpet sweeper "stars and children, subway excavations, collar buttons, menageries, boobs, Walt Whitman, Chestnut street, office boys, anglers, fixed ideas, barbers' chairs, ink wells, Japs and shower baths." Mr. De Casseres says Mr. Morley is exuberant, cavernous and enlightening, which description would as well fit C. as M. "If Mr. Holliday writes with a walking stick and Mr. Herford with a diamond stickpin, Mr. Morley writes with a pipe." Just the same we hope soon to be reading in the *Post* the results of the transfer from Independence Square to St. Paul's Churchyard, (not Trinity's, as C. had it) "a questionable move for so young a man as 'Kit' Morley," in the Casserian view.

We had heard years ago that among his other attainments Mr. De Casseres, who has had so wide an acceptance abroad, while his fame grew apace in New York, had come to be that rare bird, a real proof reader. His old friend, Reo Bennett, whom the late Mr. Bennett fired off the *Herald* payroll because Brazilian dignitaries insisted on receiving him and entertaining him as James Gordon Bennett himself, to Reo's vast delight, used to tell us at Rio de Janeiro many diverting tales of Mr. De Casseres. Reo Bennett, who is now living in disgusting affluence in southern Brazil on his banana plantation, which is as large as the Island of Manhattan, was once a proof reader himself, and on the *Herald*, too, if our memory serves. He was so steeped in his former craft that when he saw some of our proof corrections on a Brazilian publication he announced then and there that we were a literary, or at least newspaper faker, else we could never make such impossible markings to guide a printer! In all humility we admit that Reo was probably right. To get back to Casseres, he is too steeped in the hectic metropolitan life for his own good these days. He should arrange a trip to visit Reo Bennett at Hoboken-on-Hudson, Brazil (where Reo has a *paraty* distillery, by the way) and get a novel angle on the world. He would return to us with a new fund of amusing philosophy!

For Sid—Strictly Private

DEAR SID:—We received from St. Louis the neatly engraved invitation, reading:

The honor of your presence is requested
at the Jefferson Hotel
on Monday morning, ———
at eleven o'clock
on which occasion, Miss Margaret E. ———
The Physically Perfect Woman,
will demonstrate how she attained perfection,
talk on physical culture and be examined by
members of the Medical profession.

Our dad had it all figured out when we were very young that we should be a physician, but somehow we balked the old gentleman and thwarted his purpose. A paternal parent, out of his ripe experience, nearly always knows what is best for us. In later life it is not infrequently brought home to a fellow, that if

he had followed the governor's advice, he would have been happier.

Yours dejectedly,

Francois.

Father Writes About Bob

Bud writes us from Los Angeles about his young hopeful, Bob, aged four. Bob's mamma had told him he was to have a long desired baby sister and that when she came she was to be named Frances. Bob talked a good deal about "Frances" and was anxious to see her. The time came when Bob was invited to the hospital with his daddy to inspect the new arrival and the nurse took him to have a peep.

"What do you think of your new playmate?" the nurse asked immediately afterward in the corridor.

"Aw, pretty fair," returned Bob, "but haven't you got any others?"

"Certainly we have," offered the nurse. "If you will come with me, I will show you some, and if you like one of them better, maybe we can arrange to trade."

Bob looked carefully at four or five and finally decided:

"These are all right, but I guess we will keep the red one."

At home later, a neighbor inquired: "What about the new baby, Bob?"

"Well, Frances is here all right," came the reply in a more or less resigned tone, "and his name is Theodore!"

All-Around Utility

YOUNG MAN—College student desires position in family as tutor, secretary; pianist and chauffeur; references. V 277 Times.

In his odd moments this domestic Pooh-Bah might be prevailed upon to attend to the family brewing, sewing, cooking and caring for the furnace.

The Time to Laugh

Our old friend of Thirty-first Street, *Life*, had a "Profiteers' Number" recently in which was uttered in type and in picture many a truth that was no joke. It is a subject, which in spite of *Life's* humorous treatment of it, is distinctly not a source of merriment for most folk. We respectfully and solemnly set forth that the time for laughter will not be until:

Those who sell unlined mixtures of cotton waste, shoddy and wall paper as suits of clothes at $75 per;

Those who vend mediocre shoes, and worse, at 300 per cent. profit;

Those who purvey ancient storage eggs at seven, eight or nine cents apiece, while putting into storage the really fresh-laid eggs;

Those that foist sawdust-like bread, which does not nourish, upon poor folk at double the prices formerly asked for real bread;

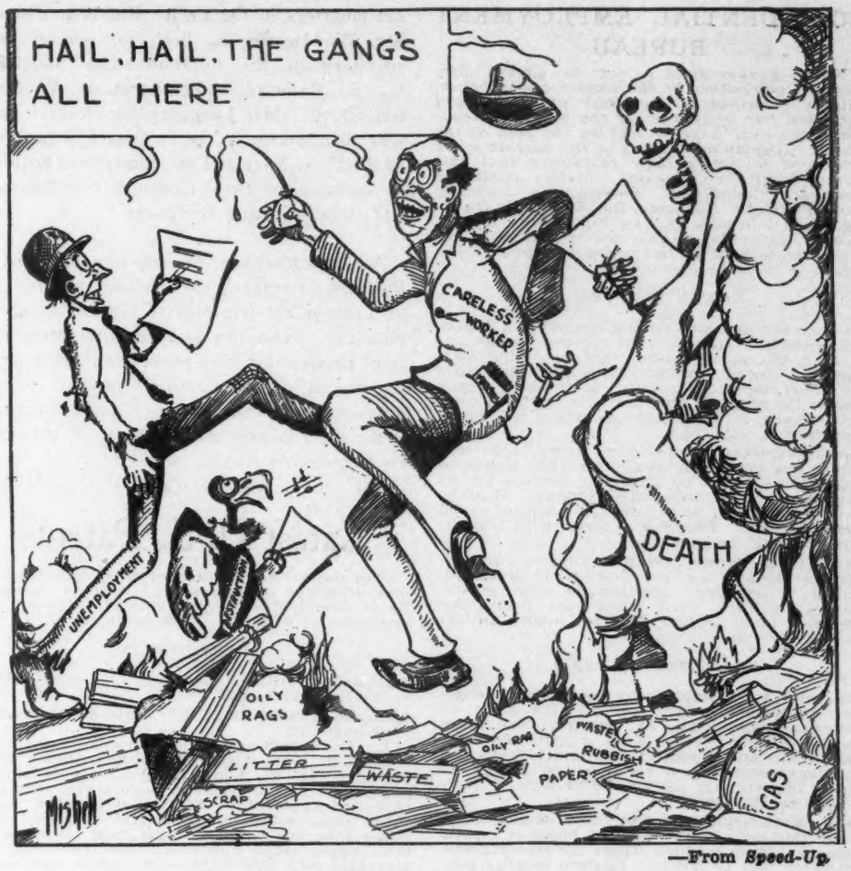
Those that dispense worked-over butter which turns rancid in 48 hours, at 90 cents a pound;

Those that mulct women and little children for all the necessities of life; and

Those who, after their robberies, breed discontent and unrest by their lavish and vulgar expenditures—

Are to be found twisting rather uneasily on spits over slow fires fed gleefully by the spike-tailed, ruddy-faced gentry of Gehenna.

When that time arrives—and in one or another equivalent it will come—loud, raucous guffaws will ascend to the firmament as an evidence of just how funny profiteering is!



—From *Speed-Up*

THE DANCE OF DESTRUCTION

Reading *The Nation* these days? Neither are we. But Oswald Garrison Villard's paper is now reported to be making money with a circulation around the 60,000 mark, as against a scant 10,000 only about a year ago. All of which goes to show how the parlor radical, like water, seeks his own level. *F. J. T.*

The Oxy-Acetylene Welder

[With Apologies to a Poet]

He stands in the middle of Hell an' grins,
Where a salamander would choke,
His hide is constructed of elephant skins,
The throat of the brute is as black as smoke,
An' his lungs are a similar shade,
An' he hasn't a shirt to his sweating back
When he's sweltering at his trade.

Where the preheating torches snort an' roar,
Or the charcoal fires burn,
Or out on the big break-down job
He has his living to earn
An' all he does is to play with fire
The whole of the working day,
An' breathe hot smoke to his heart's desire
As long as he draws his pay.

He tramps around in asbestos dust,
In a sort of inferno scene,
With cutting torch sputtering fit to burst,
An' molten steel that's green,
Steel that's green, and blue and red,
As it boils when the gas whoops through,
An' big sparks flying above his head
With drippin's of molten stew.

An' added to this is the fret an' fears
Of the story the cooling will tell,
An' he's listening hard with both his ears
For the snap of the busted weld.
An' will it stand the rack and strain
When its shrinking back to size,
Or will he have to weld it again,
As he mops the sweat from his eyes.

Eatin' the smoke,
Eatin' the smoke,
The flames have blistered his face,
He's singed his hair,
But he don't care,
For it's held, and he's won the race.

More than 50 firms are at present engaged in America in manufacturing potash salts. The value of these salts which amounts to about 50,000,000 lb. yearly is $20,000,000. In addition 60,000,000 pounds of potassium chloride valued at $7,000,000, and 13,000,000 pounds of potassium sulphate worth $1,500,000 are produced. These valuable salts are made from raw material which can be found in large quantities in the United States.

CONFIDENTIAL EMPLOYMENT BUREAU

NOTE—Announcements not to exceed fifty words, under either of the classifications below, will be published in the order of receipt and published free of charge for the benefit of readers in the next issue, if sent by the 25th of the month. Display advertisers in the magazine are privileged to notify their customers that this service is at their disposal. Letters should be directed, "Confidential Employment Bureau," Compressed Air Magazine, Bowling Green Building, No. 11, Broadway, New York City. Replies to advertisements, or any correspondence in regard thereto, will be forwarded promptly to the person or persons concerned.

HELP WANTED

447—Lead and zinc mining company in Joplin, Mo., desires to employ mill foreman competent to take charge of 50-ton mill operating part time. A man familiar with handling labor and operation of milling machinery would possess the required qualifications. Furnish complete details in first letter including references from former employers.

448—Company intending to make large machinery installation in South America desires to secure the services of a capable man to act as assistant to superintendent in charge. Must be man with general knowledge of machinery and handling labor. Previous experience in tropical country would be desirable.

449—Civil engineer, recent graduate, some experience in drafting and surveying preferred, wanted by company engaged in gasoline extraction at Taft, Calif. Excellent future for competent man. Salary $150 per month up, depending upon experience.

POSITIONS WANTED

884—Position wanted by mechanical engineer as superintendent of machine shop or master mechanic. Age 34, married. Ten years practical experience in large copper mines on installation and operation of machinery and concrete construction work. Seeking change for greater opportunity. Reference of highest quality will be furnished.

885—Metallurgist with five years' experience in copper refining and recovery of precious metals wishes to obtain position where his training and experience will be useful. Eastern locality preferred. Married, 32 years old, American.

886—Man, 38 years old, familiar with foundry work, especially on heavy iron castings, would like position as foreman. Willing to go anywhere and services are immediately available. Highest references from employers during last ten years.

887—Mechanical engineer, recent graduate, 24 years old, unmarried, desires position where his training will be useful. Has had some practical experience working in auto engine factory during last two summers.

888—Technical man, speaks Spanish fluently, having resided in Mexico during five years, wants position as mine manager or superintendent. Experienced in all kinds of underground work and surface equipment. Age 45, married. Will furnish complete references and further details in first letter.

889—Man thoroughly familiar with pneumatic tool practice, having extensive experience in manufacturing, repairing and assembling, wants position as supervisor of pneumatic tool repairs. At present employed in large plant. Full information and references in first letter.

Standard Oil interests are actively engaged in investigating the rich oil fields of Colombia, South America, and are represented there by the West Indies Oil Company, a subsidiary of the Standard Oil of New Jersey. Recently an inspection was made of the Tropical Oil Company's properties on behalf of the Standard. This inspection was made apparently in connection with the projected absorption of the Tropical Oil by International Petroleum, a Standard concern. According to the oil trade, Tropical Oil Co. has several wells, one of which is rated at 10,000 barrels.

The Chicago Pneumatic Tool Company announces the appointment of Messrs. Edward A. Woodworth and C. E. Laverenz as special railroad representatives attached to the staff of the manager of western railroad sales, with headquarters in the Fisher Building, Chicago. Mr. Woodworth has been for several years secretary of the Committee on Standards, U. S. Railroad Administration, Washington, D. C. Mr. Laverenz for several years was an inspector in the Ordnance Department of the U. S. Navy and previously held positions as foreman of the Chicago & Northwestern and Illinois Central Railroads.

A contract has been recently signed giving the Fairbanks Company the exclusive distribution of Lincoln Electric motors for industrial applications. This line includes alternating current motors for two-phase and three-phase circuits in capacities from one-half to 500 horse-power. The Lincoln Electric Company is the third largest manufacturer of industrial electric motors in this country.

Latest U. S. Patents

Full printed uncertified copies of specifications and drawings of any patent may be obtained by sending ten cents (not stamps) to the Commissioner of Patents, Washington, D. C.

DECEMBER 23

1,325,543. TUBE-CLEANER. Luster Stiles, Jr., Evansville, Ind.

1,325,676. PULVERIZER. David McKelvey, Chicago, Ill.
1. An apparatus for the purpose set forth comprising a housing, an impact member supported within the housing, means for delivering material into the housing, a centrally disposed tube arranged below the impact member, blast tubes communicating with said centrally disposed tube and provided with inlet openings in their upper sides, and means for delivering an air blast into said tubes and across said inlet openings.

1,325,775. AIR-CIRCULATING APPARATUS. Albert Babendreer, Ocean Springs, Miss.

1,325,796. BARREL-EMPTYING APPARATUS. Philip Miller, Kansas City, Mo.

1,325,811. OIL-BURNING APPARATUS. Maurice L. Stanard, Kansas City, Mo.

1,325,912. PNEUMATIC ACTION FOR PLAYER-PIANOS. Jesse Peter Rogers, Bluffton, Ind.

1,326,025. PNEUMATICALLY - OPERATED CONTROLLER. Frank E. Case, Schenectady, N. Y.

1,326,027. FLUID - COMPRESSOR. Georges Claude, Paris, France.

1,326,043. CENTRIFUGAL COMPRESSOR. Gustav Flugel, Berlin, Germany.

1,326,146. LIQUID-FUEL BURNER. Frank Stevens, Philadelphia, Pa.

DECEMBER 30

1,326,195. TUBE-BEADING DEVICE. Chas. E. Hasty, Cleveland, Ohio.

1,326,211. AIR-BRAKE APPARATUS. Spencer G. Neal, New York, N. Y.

1,326,228. CAR-DOOR MOTOR. Walter V. Turner, Wilkinsburg, Pa.

1,326,241. GLASS-DRAWING APPARATUS. William Westbury, Okmulgee, Okla.

1,326,293. AIR-COUPLING. Carl Raymond Schrader, Pulaski, Va.

1,326,875. RUBBER - WORKING MACHINE. Ira H. Spencer, West Hartford, Conn.

1,326,399. DRILLING-ENGINE. George H. Gilman, Claremont, N. H.

1,326,483. PAINT-SPRAYING NOZZLE. Daniel A. Doran, Yonkers, N. Y.

1,326,620. AIR-PUMP. Aaron Terry, Springfield, Mass.

1,326,652. AIR-PUMP. Raymond N. Ehrhart, Edgewood Park, Pa.

1,326,825. PNEUMATIC ROCK - DRILLING MACHINE. Gustaf Andersson, Stockholm, Sweden.

JANUARY 6

1,326,901. PNEUMATIC CLEANER. George W. Allen, Boston, Mass.

1,326,961. APPARATUS FOR LIQUIFYING AIR. James F. Place, Glen Ridge, N. J.

1,327,064. AIR-GUN. Otto Seemuller, Detroit, Mich.

1,327,112. VACUUM DISPENSING APPARATUS. Howard M. Nicholson, Arthur D. Nicholson, George B. Nicholson, and William T. Lowery, Pittsburgh, Pa.

1,327,218. BLOWER. Adolph A. Thommen, Chicago, Ill.

1,327,287. AIR-FILTERING SYSTEM FOR COOLING THE MOTORS OF ELECTRICALLY DRIVEN RAILWAY-CARS. Robert E. Miller, Altoona, and George H. Liebegott, Duncansville, Pa.

1,327,294. PUMP OR COMPRESSOR. Arthur Edwin Leigh Scanes, Ashton-on-Mersey, England.

1,327,416. PNEUMATIC-TIRE ALARM. Louis Anderfuhren, Baltimore, Md.

1,327,419. MOLDING-MACHINE. Allan S. Bixby, Indianapolis, Ind.

1,327,509. COOLING AIR IN SUBMARINE AND SUBMERSIBLE SHIPS. Harold E. Yarrow, Scotstoun, Glasgow, Scotland.

JANUARY 13

1,327,609. DRYING-TUMBLER. William Bartholomew, Chicago, Ill.
1. In combination with a drying tumbler having an air circulating blower which repeatedly forces a body of air through the drier, a delinting chamber having a screened communication with the blower, and having a lint discharge port, means for transferring lint from the screen to the lint discharge port, and means whereby the blower delivers to the delinting chamber air in excess of that which it draws through the screen of the delinting chamber and thereby sets up a lint discharging current through said port.

1,327,718. PNEUMATIC - DESPATCH - TUBE APPARATUS. James G. Maclaren, Mamaroneck, N. Y.

1,327,731. PNEUMATIC MOTOR FOR PIANO-PLAYERS. Claus E. Peterson, Worcester, Mass.

1,327,783. AIR-PUMP. Stephen G. Skinner, Chicago, Ill.

1,327,833. AIR-PUMP. Joseph Lafrance, Montreal, Quebec, Canada.

1,327,926. AIR COLLECTING AND DELIVERING APPARATUS. William D. Scott, Martins Ferry, Ohio.

1,327,940. AIR-CUSHION FOR PUMP-OPERATING MECHANISM. Brynte Brynteson, Odebolt, Iowa.

1,327,968. AIR - BRAKE - CONTROLLING MECHANISM. Thomas W. Scott, Baltimore, Md.

1,327,973. AUTOMATIC AIR-BRUSH MACHINE FOR COATING LAMPS, Etc. Claude E. Allen, Kenosha, Wis.

1,327,975. PROPULSION OF AIR AND OTHER GASES OR FLUIDS. Hertha Ayrton, Hyde Park, London, England.

1,328,088. INFLATING DEVICE FOR PNEUMATIC APPARATUS. William D. Lutz, Allendale, N. J.

1,328,133. AIR-PRESSURE LIQUID-TRANSFER DEVICE. Harry G. Diffenbaugh, Salt Lake City, Utah.

1,328,232. AIR-PUMP. Joseph Kean, Des Moines, Iowa.

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